SCIENTIFIC AMERICAN

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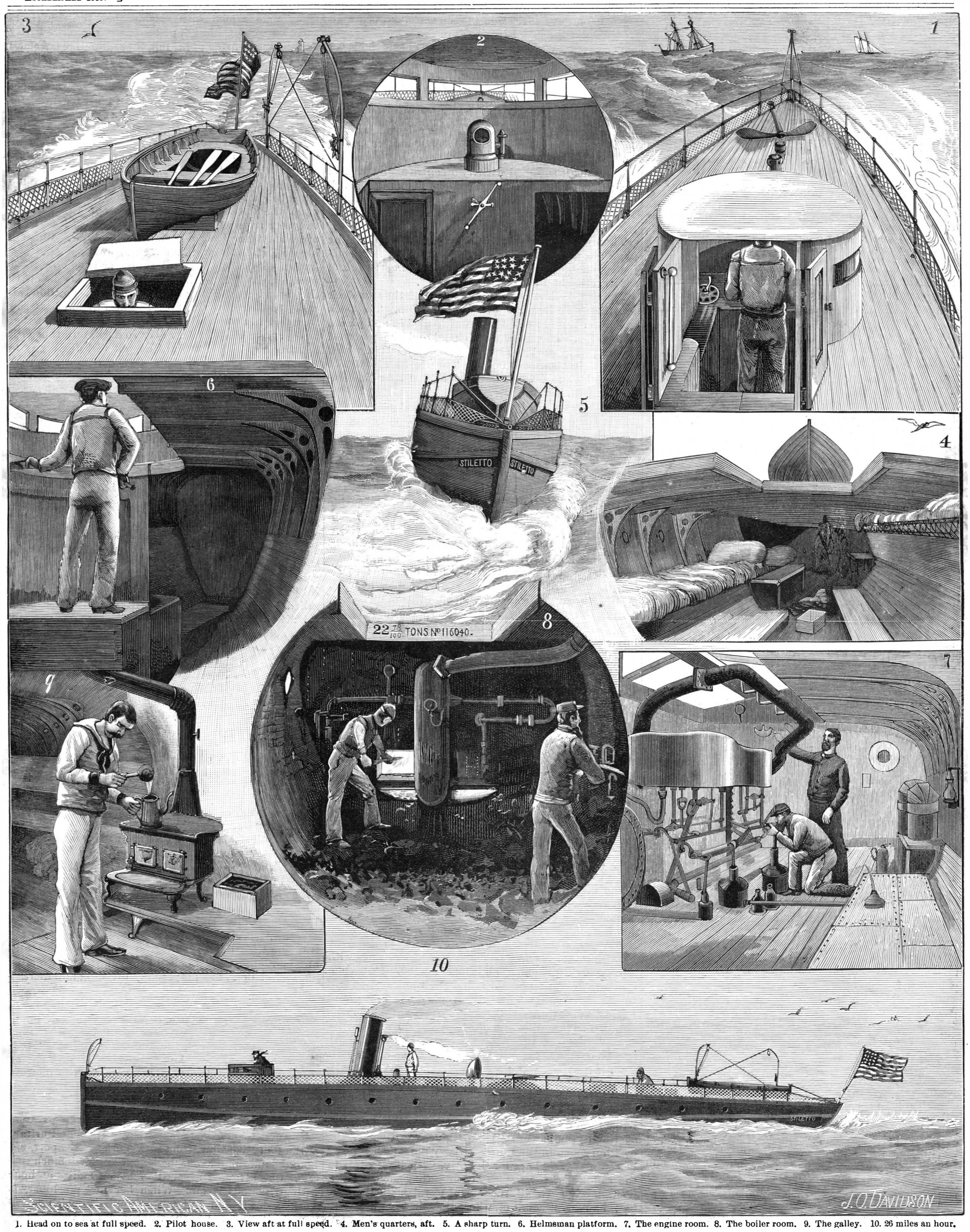

1. Head on to sea at full speed. 2. Pilot house. 3. View aft at full speed. 4. Men's quarters, aft. 5. A sharp turn. 6. Helmsman platform. 7. The engine room. 8. The boiler room. 9. The galley. 10. 26 miles an hour.

OUR NEW NAVY—THE STILETTO RECONSTRUCTED AS A TORPEDO BOAT.—(From sketches made for SCI. AM. on special trial.)—[See p. 276.]

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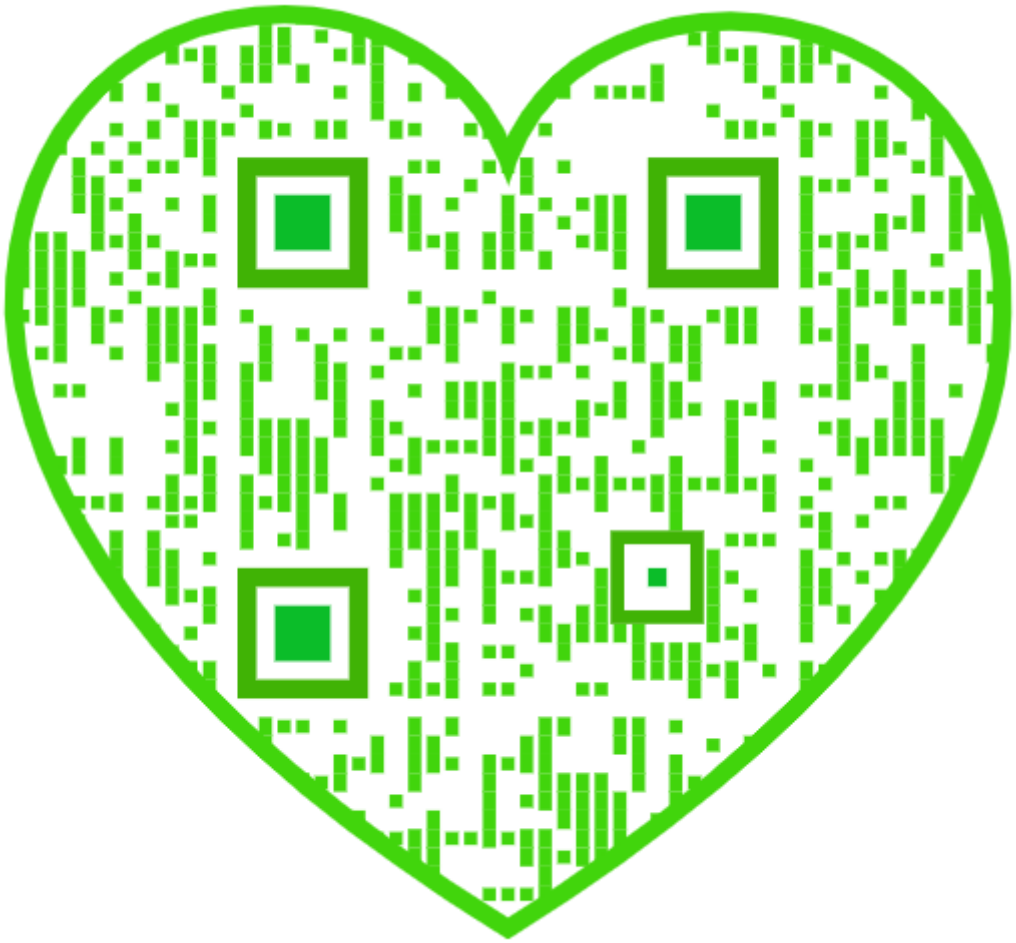

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OPENING OF A NEW DRY DOCK AT NORFOLK, VA.

The great dry dock lately built by the Chesapeake Dry Dock and Construction Company was opened for business on the 24th of April with appropriate festivities. A large company of distinguished personages, engineers, and government officials was present. The dock is built on the well known plan patented by J. E. Simpson, of Brooklyn, N. Y. It consists of an immense caisson, with an end gate, something like a canal lock. In docking a ship the gate is opened, the caisson is allowed to fill with water, which sinks the caisson to the required depth. The ship then passes in over the floor of the caisson and is held in the desired position; meantime the water is pumped out of the caissons, which rise and lift the vessel out of water. These docks are now in all parts of the world.

The present dock is one of the largest of its kind ever constructed. It is 630 feet long from head to outer sill; 130 feet wide at top and 50 feet at the bottom, and 33 feet deep, with a slope in the bottom of 24 inches to the 560 feet. The approach to the dock is piling, 250 feet long and 150 feet wide, while on each side piers 80 feet wide afford ample wharf room. The caisson is an iron structure, 96 feet long on top, 50 feet at bottom, and 33 feet deep.

The dock is supplied with two centrifugal pumps of a capacity of forty thousand gallons per minute, each of which empties it in one hour and thirty-six minutes. The combined power of the two engines is 500 horse power.

There is in course of construction a shipbuilding plant alongside of the dry dock which will, when completed, enable the company to do the finest work of construction and repair in the country.

The vessel selected for the first trial of the new dock was the great ironclad war ship Puritan. The dock was lowered and the Puritan was hauled in and placed in position. The gates were closed and the powerful pumps put to work to clear the dock of water, which was done in about two hours. The Puritan is 300 feet long and 60 feet wide, but she looked small in comparison with the great dock.

Mr. Simpson, the inventor, was present and greatly enjoyed the occasion. He is now quite advanced in years, but is still active.

HEAVY QUICK-FIRING BATTERIES.

A new and interesting feature of British naval armament is the substitution of quick-firing guns for the mammoth pieces heretofore considered indispensable in the battery. These new pieces are not of the pepper-box variety, such as the Maxim, Nordenfelt, Gardner, and old-style Hotchkiss guns, which fire from 350 to 600 small shots a minute. The new arm, though after the same pattern, has only five chambers to its barrel, but fires heavy shot, shot capable, at short range, of piercing from 6 to 9 inches of iron. The new Hotchkiss quick-firing gun, offered to and refused by our ordnance department, and now being made in France, has a six-inch caliber, throws ten shots a minute of aimed fire, each of thirty-three pounds. The weight of the new projectile is nearly 110 pounds, the velocity about 2,000 foot-seconds with a charge of forty pounds of powder, and a penetration of nine inches of iron. The English, though at first disposed to adopt this arm, have recently devised a similar one, which is now being made at the Armstrong works, and six cruisers in course of construction are to be armed with it. These vessels will vary in size from 1,600 to 1,900 tons displacement, have armor belting from just below the water line to a point above high enough to protect the engines and quarters, and will be quick-heeled. The new quick-firing Armstrong guns composing their batteries will be scarcely forty-two hundredweight each, of less than five inch caliber, fire a projectile weighing forty-five pounds, with a muzzle velocity of 2,073 foot-seconds, and have a penetration of nine inches of iron.

The investigation of the causes which have led, or rather which are leading, to the abandonment of the mammoth gun principle of armament is an engaging and instructive study. It is not so many years ago when the struggle between gun and armor was in progress. Floated armor reached its maximum of 24 inches with a heavy oaken backing, and then stopped. More than that was found to seriously imperil the buoyancy of the modern ship. Then a gun was made that would readily pierce this, and it was declared that the marine gun had advanced in efficiency beyond the armor that could be opposed to it upon the seas. Mathematically speaking, it was incontestable; but from a practical standpoint there was no such certainty. A charging trooper, let him be ever so good a shot with the carbine, is no match for a foot soldier, be he ever so awkward with his piece. Infantry are notoriously more reliable than charging horse. The squares of Napoleon at the Pyramids beat 10,000 Mameluke cavalry—the best horsemen in the world. Heavy guns afloat might be compared, perhaps not inaptly, with light arms in the saddle as to reliability of fire—they shoot from a rocking base. In all the recent naval maneuvers we have had any account of, where these heavy guns were brought into action, the uncertainty of aim was apparent. The ship had to be aimed rather than the gun, and this with a ponderous iron vessel, especially if there is much of a sea on, is not an easy task. Slowly the heavy gun is trained into position, and then, presto! the ship under it sways away in the sea and the target is gone! But though the heavy gun was not sure to hit its mark, the ship it was mounted upon, with its powerful armor, was thought at least to be fairly invincible, for nothing could approach it save under similar disadvantage.

Then came the torpedo boat—a flying target that to attempt to train a heavy gun upon was but a waste of labor. To guard against this danger, secondary or quick-firing batteries were mounted in the tops and set up on the poop and fo'c's'le. But soon the torpedo boats were armed with shields that the shot from these batteries could not pierce. Now come the newly devised quick-firing guns, not of the hundreds of small shot a minute variety, but capable of throwing ten heavy shot a minute—shot capable, as said before, of piercing nine inches of iron at short range; an armor that, it is safe to say, no small boat, built for speed, for running up quickly and dashing away again, could carry.

It is not easy to see, however, how in any fair computation the believer in big ships can cry checkmate to the torpedo boats. As long as such elements as darkness and thick weather remain, as long as big guns belch forth clouds of powder smoke to hang upon the waters, it would seem as if these quick-winged terrors might still remain potent, at least when operating in or from a harbor or roadway. When a big ship, operating near shore, can no longer see any known points, because of darkness or smoke or thick weather, she must either come to anchor or be off to the broad seas. Once she anchors, her position can easily be learned by compass. The torpedo boat can then feel her way silently out to her, let the weather be ever so thick, the night ever so dark, but the most approved quick-firing guns cannot feel their way to this advancing destruction. Hence it would appear that, up to date, the attack of big ships upon a harbor is not yet equal to the possible torpedo boat defense.

The Australian Rabbit Pest.

It is stated that M. Pasteur's plan of exterminating the rabbits by inoculation with transmittable virus has proved to be a failure in Australia. The reward of $100,000 offered by the N. S. W. government for an effective mode of destroying the rodents is as yet unclaimed. Mr. P. L. Sclater, of the London Zoological Society, writing to *Nature*, says:

Mr. W. Rodier, of Tambua, Cobar, New South Wales, has forwarded to this society a printed sheet, containing, as it appears to me, by far the best suggestion yet made for the extermination of rabbits—a subject to which my attention has been repeatedly called by various correspondents in the Australian colonies, where, as is well known, the damage done by these animals is enormous. Mr. Rodier states that his plan has been in operation at his station in New South Wales for about eight months "with the utmost possible success," and has cleared the country of rabbits. It is a very simple plan. Ferrets and nets are used in the usual way to capture the rabbits, but while all the females taken are destroyed, the males are turned out again uninjured.

The results of this mode of operation are that the male rabbits, as soon as they begin to predominate in numbers, persecute the females with their attentions, and prevent them from breeding. They also kill the young rabbits that happen to be born; and even, as Mr. Rodier asserts, when they largely predominate in numbers, "worry the remaining does to death."

This is all strictly in accordance with what we know takes place under similar circumstances in the case of other animals, so that we can readily believe it to be likely to happen.

The ordinary mode of trapping, as Mr. Rodier points out, is more likely to increase the number of rabbits than to diminish them. For reasons which he clearly explains, more buck rabbits are always killed by the trappers than does. Thus the does predominate in numbers, and, a few bucks being sufficient for a large number of does, are perpetually breeding and increasing the stock.

The plan advocated by Mr. Rodier is so simple and easy that I cannot doubt it will be widely followed when known. No disease that might otherwise cause injury is introduced, no other noxious animal is proposed to be imported, but advantage is taken of the well-known natural laws which regulate the increase of life to effect in this instance a salutary decrease.

A Great and Fast Passenger Steamer.

The first trip of the new passenger steamer Puritan, of the Fall River line, from New York to Newport, *via* Long Island Sound, was made April 24, with much success. She attained a speed of over 20 miles an hour with 65 pounds steam. When her new machinery is worked down and full power applied, which is 110 pounds, it is believed she will surpass in velocity any passenger boat afloat.

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Time Servers.

How many men there are, holding good paying positions as journeymen, who are really of no value unless kept constantly under the eye of the foreman or their employer! They are simply time servers, who take no interest in the business they represent beyond the actual time necessary to count them a day's work. They work when closely watched because they are obliged to, not from any motive of honor or interest in the business.

What can be expected of such workmen but that they will shirk their work and idle their time at every opportunity?

If you cannot give your employer your full time for which he pays, and take some interest in his business, you had better leave him at once. To this he is entitled, and has a right to expect it of you.

If your mind is not upon your work, you cannot expect to accomplish it with any degree of satisfaction to your employer or credit to yourself.

In going about from one shop to another it is a very easy matter to pick out the time servers. Upon the slightest pretext they drop their work to talk or look about, and are always ready to get out of the door the moment the clock strikes six, and their example is very rapidly followed by the apprentice or younger workmen. They have to be constantly watched, and this fact, being known to the firm, is not long in having its results.

Employers are more generally knowing to the habits and qualities of the men they employ than the men often realize, and they invariably know who are the time servers among them, so that when there comes a convenient opportunity or a lull in business, these are the first to be discharged.

It pays to be faithful and to do your best at all times, and more especially when your employer is not watching. If you must idle away time, do it when he is about, but don't dishonor yourself or betray his confidence by taking advantage of his absence.

This is one of the worst features of our American system. It is an example which is set by the older men, and which is readily adopted by apprentices, and it is the exception rather than the rule that we find a young man who is sufficiently interested in his own welfare and his employer's as well to give his full time and attention to his work. Those who do this are sure of success, and it is from among such that have risen those men whose names are written upon the pages of history as having made their mark in the world, and left behind not only pleasant recollections, but a shining example that is worthy of a careful imitation.—*Harness.*

The Elementary Substances.

Professor W. Crookes, F.R.S., in his recent anniversary address before the Chemical Society remarked that the spectroscope gives us a power that enables us to peer into the very heart of nature. In the extent of its grasp, and the varied character of its applicability, it surpasses the telescope, and at least rivals the microscope. The astronomer uses it in studying the chemical composition and physical condition of the sun and the stars as if they were within touch.

The biologist and physiologist find the spectroscope of value in studying the relations of animal and vegetable tissues and fluids. In terrestrial chemistry the spectroscope has already led to the discovery of several hitherto unknown elements. Bunsen and Kirchhoff discovered cæsium and rubidium by its use. Professor Crookes found thallium, and Reich and Richter iridium. By studying spark spectra, Lecoq du Boisbaudran discovered gallium in 1875, and Drs. Gladstone and Russell in this country have recently shown that a study of absorption spectra gives very interesting results. In his own investigation of the rare earths he had endeavored to reduce their number as far as possible by a searching examination of their properties, but in this investigation he had found that the task he had set himself was of a very complicated nature.

The rare elements of the didymium group are four in number, viz., didymium, decipium, samarium, and lanthanum, and of these his own work and that of Continental observers prove that didymium has not a simple structure. By using a specially constructed binocular spectroscope, the absorption spectra of different solutions of didymium nitrate could be automatically mapped, and from the results obtained by its use he is assured that didymium is not indivisible. From a recent study of the glow spectra of the pure oxides of the elements, he has found that after successive fractionation of crude alumina, the red glow which is characteristic of this body gives place to traces of a complicated line spectra. By pushing the fractionation still further, he has been able to identify this line spectra with that of decipia, and has reproduced it by adding decipia to the crude alumina. He is of opinion that by the fractionation of the crude alumina he has determined the presence of a rare element, or possibly a meta-element, in the alumina, but must devote much time to the subject before any definite conclusions can be drawn from the work.

In endeavoring to answer the question, What is an element? it must be borne in mind that, taking didymium as an example, the different methods of fractionation applied to it yield different products, and that it is therefore obvious that even these parts of the original are not elemental in character; in other words, didymium is divisible in different ways. It is evident that chemists have not yet reached the "bed rock." At present we must wait for further light, and open what can be called a "suspense account," of which all these spectroscopically discovered new substances may be provisionally called meta-elements. It becomes more and more probable that between the primitive atom and the molecule there is a gradation of aggregates of varying complexity, and that these aggregates have been mistaken in times past for the elemental atoms.

Ordnance Work.

According to the *Engineering News*, twelve six-inch ordnance rifles for the United States government are now being built by contract, six each at the South Boston Iron Works and the West Point Foundry. The forgings and material for the guns are being made by the Midvale Steel Company, of Philadelphia, their contract being directly with the government. The contract for the guns was made last November, with the provision that the first gun should be completed within six months. The construction of the guns is under the supervision of a naval officer, Lieut. Commander Eaton, U. S. N.

The South Boston Iron Works also have the contract for furnishing the gun carriages, gun mechanism, and steering gear apparatus for the double turreted monitor Terror. The price is $200,000, and it is required that the work shall be completed and erected on the boat one year and six months from May 1.

The gun carriages for the Terror are of the pneumatic type, the recoil and counter recoil is against cushions of air. The gun on this carriage will run on a horizontal plane, instead of on an incline, as in the Sicard carriage on the Boston and Atlanta. The first of these new carriages is already at the Annapolis proving grounds and will be tested immediately. The cost to the government of this carriage is to be $19,000.

The Terror's guns will be elevated by hydraulic power applied under the after part, the pivoted point being on the gun port. The gun is loaded from a three-cylinder revolver, the gun being lowered after firing until its chamber is in line with that of the cylinder, at which moment a hydraulic rammer pushes the charge into the gun. This arrangement is similar to that used on the Vesuvius.

Besides the work already mentioned, the South Boston Iron Works are furnishing 200 projectiles for the new 12-inch rifle mortar, now at Sandy Hook, and the only one in the United States. The projectiles are of cast iron, pointed, with two copper bands about one-fourth inch wide shrunk on their exterior to permit their taking the rifling. The projectiles cost about $50 apiece.

Great Irrigation Works.

The Russian government decided about a year ago to commence some irrigation works near Merv for the purpose of rendering the crown lands more suitable for the cultivation of cotton, and during the period which has since elapsed the first part of the scheme has been completed. A dam—30 feet high—has been built across the river Murghab, in the Merv oasis, at a distance of fifty miles from the village of Sultanbund, and the vast quantities of water which are collected in this manner are being distributed to the surrounding country by means of a network of sluices and canals. It is confidently expected that the continuous irrigation of the lands will be insured throughout the severest droughts. It appears that the Russians are intending to do their utmost to develop the crown lands in this district, as they are establishing a number of meteorological and other stations for the collection of information as to the temperature, moisture, and rainfall.—*Industries.*

A New Aliment from Wheat.

According to *Le Genie Civil*, Dr. Dujardin-Beaumetz recently exhibited at the Paris Academy of Medicine a new alimentary substance—"fromentine"—which is obtained from wheat by the aid of special millstones. Fromentine is the embryo of wheat reduced to flour and deprived of the oil which it contains. The substance contains three times more nitrogenous substance than meat, and a strong proportion of sugar. Thus, the amount of nitrogenous matter in it is 51 per cent, while that of the richest meat, mutton, is but 21 per cent, and the proportion of digestible substance reaches 87 per cent of the total weight. Hence it would appear that it might advantageously replace powdered meat as a concentrated food. It can be used for making soups, and even for making biscuits, the taste of which would not be disagreeable.

The wheat germs employed are a by-product in the Schwietzer process of manufacturing a flour which can be kept for a long time without deteriorating.

Concerning Moths.

Regarding moths, says the *Upholstery Trade Review*, many are not aware that the damage is done when the millers commence to fly, as their very presence indicates the absence of the worm. It is to prevent the miller incubating that precautions should be taken. A large proportion of the millers never hatch eggs, but die without causing any harm. The male miller, which does not fly, but runs very rapidly, is quite easily detected by his triangular shaped figure, but, keeping himself out of sight, he is not so easily found. His hiding explains the devious flights of the female in her search. The killing of one male is equal to the extinction of many ordinary millers. The male miller is commonly known by the name of "silver fish."

Carpets are seldom troubled with moth worms except where hatched in a dark, unprotected space, and where it is moderately warm. It is for this reason no doubt that carpet houses are seldom, if ever, troubled by them, the stocks in the larger houses being disposed of between seasons. Nearly all the trouble from moths emanates from the furniture, the burlap inside the outer covering being their best field for work, where they can be free from annoyance and find plenty to eat. Many furniture dealers realize their danger, and cleanse the burlap used with naphtha.

It is when the worms are either tired of their food or it lacks the nourishment that they desire that they seek an outlet and drop upon the carpet.

Cleansing carpets by the naphtha process is regarded as the surest and most satisfactory where there is the slightest suspicion of moth eggs or worms. It is especially adapted to pile carpets. Caution should be exercised as to the purity and clearness of the naphtha used and the thorough extraction of the grease, else the dirt adheres more easily than before. Where carpets are to remain in storage some time, the odor can be left in the carpet. A more thorough cleansing can be assured by having the carpet beaten first. A surface application of naphtha will drive the impurities through the article, to be absorbed by that which is under it.

A School of Electricity at Princeton.

The new department of Electrical Engineering at Princeton University is to be opened next autumn, and examinations for admission thereto as well as for the regular classical and scientific departments will be held in the principal cities of the East and West during the latter part of June. Catalogues giving full particulars in regard to this new course are obtainable of the college registrar at Princeton, N. J.

It is of some interest to observe the number of prizes that are given in one of our larger universities during a college year. Ever since the establishment of the fellowship system at Princeton the numbers in attendance have increased and the standard of scholarship has been raised. There are the following fellowships open to competition by graduates of any university: Fellowship in Biology, which brings an income to the incumbent of $400, Social Science Fellowship $500, English Fellowship $400, Archæological Fellowship $400. The members of the senior class may compete for the following fellowships: Mental Science $600, Experimental Science $600, Mathematics $600, Classics $300, History $250, Modern Languages $250.

There are fifteen prizes offered during the senior year, eight in the junior year, three in the sophomore and one in the freshman year. Those who enter the freshman class next autumn will be eligible to compete in their sophomore year for the Steinecke prize for the best student in the classics. This prize of $1,500 is the largest prize offered by any college in this country.

Wilmerding, Pa., a Model Town.

George Westinghouse, proprietor of the air brake patent, which made him wealthy and famous, proposes to build a town for his employés at Wilmerding, near Allegheny, Pa. He has bought 600 acres of land, and will spend $3,000,000 in improving it. A new machine shop, costing $1,000,000, will give employment to 5,000 hands, and turn out five times the work done at the present mills in Allegheny. The place is to be modeled after Pullman, Ill. There are 42 plots in the town site, each containing a number of lots. One of them will accommodate a fine hotel and a handsome club house, to be built together, and to form the most pretentious structure architecturally in the new city. Lots that are not taken by employés or others by a certain date will be built on by the company. About two hundred houses are now under way. The improvement company has bought 625 feet of frontage on the Monongahela River, near Fort Perry, to establish waterworks capable of supplying 20,000,000 gallons a day. Sewers are now being laid in every street, and natural gas will be used exclusively for fuel.—*Springfield Republican.*

IT appears the first report of the time made by the new steamer City of Paris, on her first voyage to this city, namely, 7 d. 11 h. 33 m., was incorrect. It should be 6 d. 18 h. 53 m.

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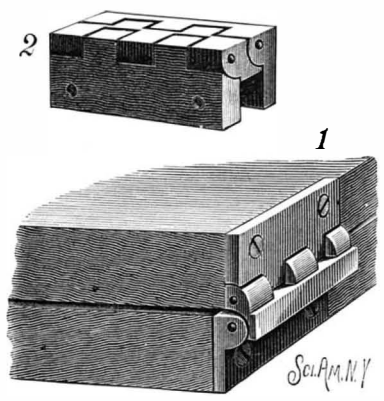
AN IMPROVED HINGE.

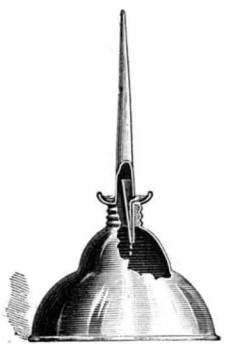
A double flush hinge, adapted to be used as a single or double hinge, is shown in the accompanying illustration, and has been patented by Mr. William S. Larimer, of Floodwood, Ohio. The hinge is formed in three parts, two of the parts being secured to the parts to be hinged, while there is an intermediate rotary supporting piece, formed with a flat face extending from end, with concave recesses and lugs having convex sides, and shoulder which abuts against one of the fixed parts when the hinged parts are in the same plane. One of the hinged parts may also, by this construction of hinge, be folded entirely back so as to rest upon the other part, especially fitting it for use in the case of upright lids of pianos, as the lid may be folded back on top of the piano out of the way. The hinge is intended to be used with doors, desk lids, covers, etc. The intermediate rotary supporting part may be omitted when it is desired to use the hinge as a single hinge.



LARIMER'S HINGE.

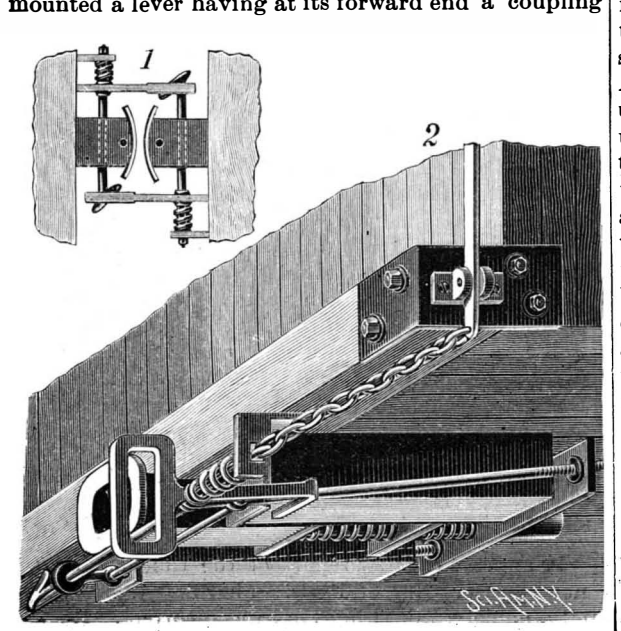
AN IMPROVED OIL CAN.

The bottom of this oil can is made stout or rigid, as there is no necessity to spring or flex it for the purpose of discharging the oil. Within the spout, near the body of the can, is a tube tapering downwardly, this tube being closed at its top, but having only a contracted aperture at its bottom. This tube is provided with an intermediate vent or air aperture passing through the side of the spout immediately above a drip pan, the tube serving the double purpose of draining whatever oil may gather in the drip pan back into the can and also as an air vent when the can is in use. The tapering shape of the tube helps it to draw off the drip and also to more effectually act as a vent, while it is difficult for the oil to enter the smaller end of the tube when the can is inverted. This can can be used with the heaviest and thickest kinds of oil, it only being necessary in such case to proportionately enlarge the openings to the spout and vent. It has been patented by Mr. Henry Muller, of No. 551 Tenth Avenue, New York City



AN IMPROVED CAR COUPLING.

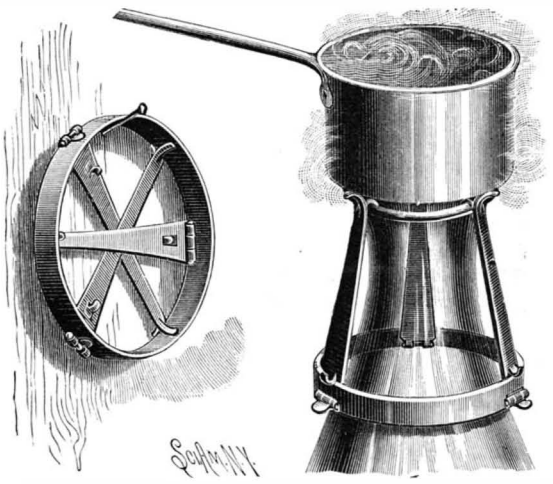
The illustration herewith represents an improved double automatic car coupler which has been patented by Mr. Manuel M. Carmona y Valle, of No. 8 Calle de la Encarnacion, City of Mexico, Mexico. It is designed to be entirely automatic, being of simple construction, having great resistance and no loose pieces, while it can be disengaged from either car, and can be used in connection with cars furnished with the common coupler. The drawbar spring at the rear of the drawbar has follower plates and a drawbar cage with keys arranged in the ordinary manner. Through the drawhead extends a horizontal bore or slot adapted to receive a coupling pin, held in the position shown in Fig. 1 by a spring abutting against a stop carried by the car body, the free end of the pin carrying a forwardly extending arm. Upon the other end of the pin is mounted a lever having at its forward end a coupling link, while the rear end of the lever is forked to embrace a rod connected with the car body, or such rear end may be connected to a spring, for adjusting the link at about the desired height. As two cars come together the forward lengths of the coupling links bear against the inclined arms of the opposing coupling pins, moving them against the tension of their springs until the extended end of each of the pins clears the forward link length, when the springs act to throw the pins into coupled position, as shown in Fig. 1. To use this coupler with the ordinary forms of coupler, a simple form of saddle is provided, to be passed over the drawhead, and having eyes through which the coupling pin is passed. To these eyes are connected rearwardly extending auxiliary drawbars, which pass through apertures in the rear drawbar plate. This coupler is designed to be used automatically, even if the couplers are not of the same height or if they deviate laterally, while with its use no change is required in platforms, and it is applicable to both freight and passenger cars. A link and pin can also be added, if desired, and used in connection with it in going up steep grades.



CARMONA'S CAR COUPLING.

A LAMP HEATER FOR VESSELS.

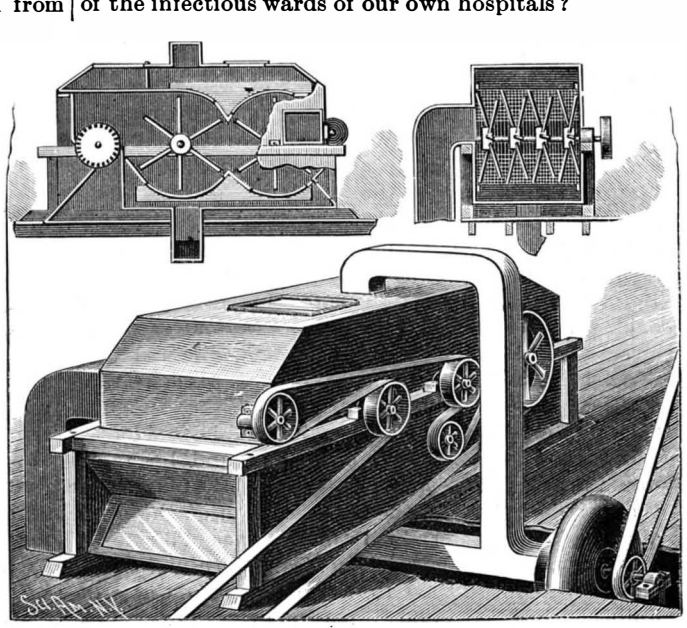
A device for use in connection with lamps, to utilize their heat in heating a vessel placed above the flame, is shown herewith, and has been patented by Mr. John W. Zinn, of Hawthorne, Fla. The device consists of a base of flat or band metal in the form of a ring, and having slots in which are hinged arms or uprights. The upper end of each arm is slitted vertically, and the divided ends bent in opposite directions, one of such divisions of each bifurcated arm forming a hook for suspending the device from the upper edge of the chimney of a lamp, while its opposite division is made slightly higher than the hook, these higher portions serving to support a suitable vessel above the chimney. The arms have slight projections, forming spring catches, to be sprung over the upper edge of the base to hold the arms in upright position, but when the device is not in use these arms are folded within the base, as shown in one of the views.



ZINN'S HEATING ATTACHMENT FOR LAMPS.

AN IMPROVED SEED COTTON CLEANER.

The illustration herewith represents a machine designed to draw seed cotton from a storehouse, wagon, or other point, by suction, thoroughly clean it from sand, dust, and other foreign substances, and discharge it without passing through the fan. The machine has been patented by Mr. William M. Wilson, of Friar's Point, Miss., and the small figures represent transverse and longitudinal sections. From the bottom and top of the machine tubes are carried to the side, the top tube being united to the bottom tube at the base of the machine in a single pipe, at the extremity of which is an exhaust fan. The inner ends of these tubes are in vertical alignment, and a third tube is carried from the opposite side of the machine to a wagon or storehouse containing the cotton to be cleaned. A series of three transverse shafts are journaled upon longitudinal beams, beaters being secured upon the forward and intermediate shafts, and these beater shafts revolving in opposite directions, each radiating arm of the beaters having a sheer in an opposite direction, as shown in the small sectional view. The rear shaft carries a corrugated, fluted, or brush-covered delivery cylinder. The interior of the machine is divided into three compartments, an upper and a lower one being connected with their respective exhaust tubes, while the central one is connected with the delivery tube, and is to receive the seed cotton, which is propelled through this compartment by the beaters to the delivery cylinder. The division into compartments is made by upper and lower screen partitions. A vertical gate or gravity air valve is pivoted in the rear upper end of the machine, within the central compartment, immediately to the rear of the delivery cylinder. In operation the cotton is drawn by the exhaust fan into the machine, at right angles with the forward beaters, which carry it downward and along the lower screen, freeing the cotton from heavy sand, etc., which escapes into the lower compartment. The cotton is then thrown against the rear beaters, and by them thrown against and along the top screen, removing dust or other impurities, the cotton being finally cast upon the delivery cylinder, and carried out past the air gate and discharged from the machine.



WILSON'S SEED COTTON CLEANER.

IMPROVED FEED OR NOSE BAG FOR HORSES.

The accompanying sketch illustrates an improved feed or nose bag for horses, letters patent for which are owned by the Champion Feed Bag Company, of No. 381 Pearl Street, New York City. The bag is constructed of canvas or equivalent material, but its top is of greater diameter than the bottom, and it has a protruding portion or pocket on its under side when the bag is attached to the head of a horse, preventing the feed from falling out of the bag as the horse elevates his head. The bag is also provided with two ropes instead of the ordinary one for easily and comfortably holding the feed bag in the best position upon the horse's head while the animal is feeding.

FEED BAG FOR HORSES.

Bakers, Look Out!

The fact that flour mills have been set on fire by the combustion of the particles of dust floating within the mill is conclusive; but that bakeries are liable to the same mishap we have not seen reported before.

"That fine organic particles suspended in the atmosphere will form explosive mixtures as dangerous as fire damp or coal gas was again illustrated," says the *Chemist and Druggist*, London, "recently in a Paris bakery, at 42 Rue Croix-des-Petits-Champs, near the Banque de France. There, as in most bakeries, a cloth shoot was employed for bringing the flour from the storeroom upstairs down to the kneading troughs in the bakery. Somehow a movable gas jet came into contact with the cloth, and burned a hole through, when a terrific explosion took place, blowing out the front windows, and making the whole shop a perfect wreck. Unfortunately, besides material damages, the accident caused severe personal injuries to two men, one a journeyman baker, whose face was badly burned, and a passer-by who was wounded in the head by the flying debris."

The Medical Press says there is a talk of applying telephones to the infectious wards of the French hospitals, so as to enable the sick people isolated in their contagious sufferings to have the comfort of hearing their relatives' voices without any risk of conveying infection by an interview. It certainly is a very humane idea, and would not—one would think—be a very costly one to carry out. Why not try the telephone in some of the infectious wards of our own hospitals?

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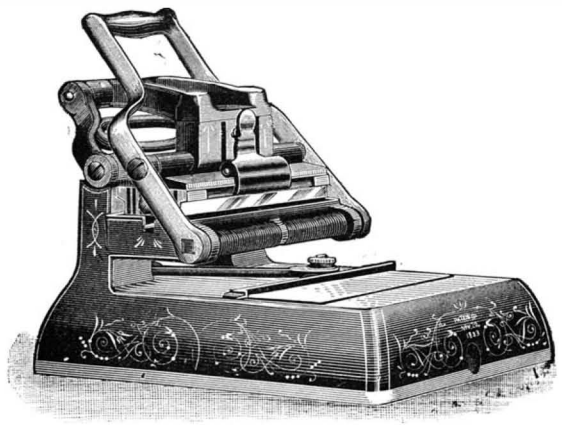
ENVELOPE ADDRESSING MACHINE.

One of the most important requisites of business correspondence is that the envelopes should be addressed in a manner not only providing every possible safeguard against misdirection, but also against being missent by the rapidly working postal clerks who have not time to carefully decipher obscure superscriptions, but must throw each letter to its respective pouch by the impression formed on the first glance.

The R. H. Smith Mfg. Co., of Springfield, Mass., who make a specialty of everything in the rubber stamp line, have recently put on the market a new device, as shown in above engraving. It is called Smith's Patent Lever Self-inker No. 3, and is, in fact, a miniature printing press of simple but effective construction, especially designed for printing the addresses on envelopes, postal cards, and shipping tags, which it does rapidly and in a most perfect manner, using their well known metal-bodied rubber-faced type, a font of which is furnished with each press, and the office boy can in his leisure moments set up the addresses and print a complement of envelopes for each of the firm's regular correspondents, returning them to the envelope boxes in which they came, simply taking an imprint on a slip of paper and folding in with imprint exposed to index them, leaving in convenient form to use from and enabling the boy to see and replenish any kinds running low.

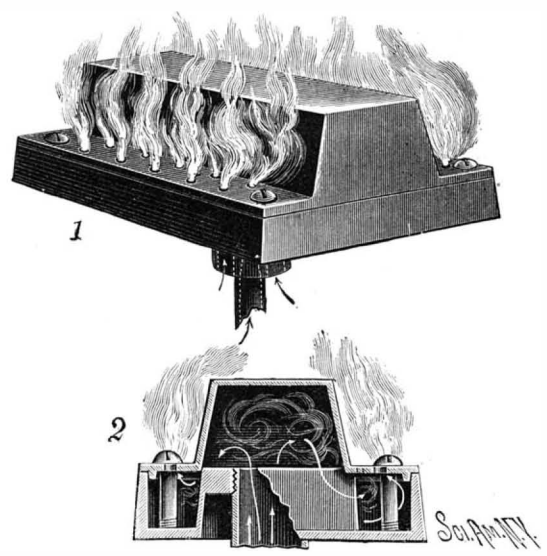


ENVELOPE ADDRESSING MACHINE.

CARLYLE described his indigestion "like a rat gnawing at the pit of his stomach," and said his best physician was a horse. Some one has jocosely remarked the outside of a horse was the best thing for the inside of a man. Calvin was a sufferer from indigestion, so was Emerson, so was Cowper, so was Darwin, so indeed were many of the great men of modern times. An old physician used to say: "Tell me how a man digests, and I will tell you how he thinks."

A GAS BURNER FOR HEATING PURPOSES.

The illustration herewith represents a gas burner which has been patented by Mr. Phillip Lesser, of Ridgway, Pa., Fig. 1 giving a general view of its appearance, and Fig. 2 showing a broken sectional view. The base casting is made with a central elevated platform and a narrow channel or chamber surrounding the whole interior of the burner. Upon the upper edges of the outer walls of the base casting is bolted a cap plate, the bolts being passed through longitudinal flanges covering the exterior channel of the base, while the central portion of the cap plate consists of a longitudinal elevated chamber, the side flanges having numerous perforations for the escape and burning of the gas at the sides of the central elevated chamber. The gas is admitted to this central chamber above the top of the elevated portion of the base through an opening in which a gas pipe may be fitted, the gas becoming then heated, and expanded and mixed with air, when it passes downward and enters the surrounding channels formed in the base, as shown by the arrows, and in this heated and expanded state issues from the burner perforations, producing intense heat.



LESSER'S GAS BURNER FOR HEATING PURPOSES.

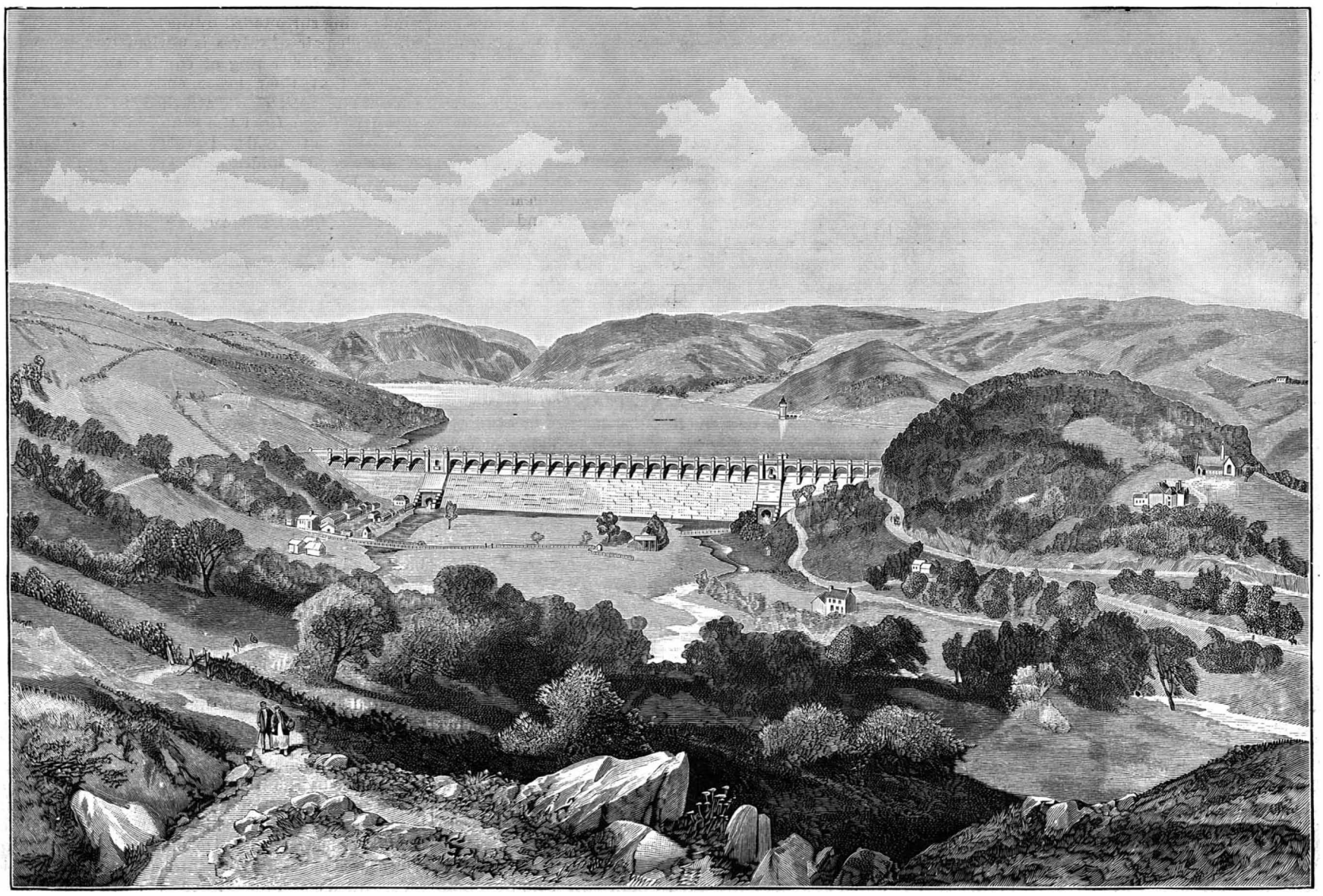
THE VYRNWY LAKE OF THE LIVERPOOL WATER WORKS.

One of the grandest engineering works of modern times, undertaken by the Corporation of Liverpool to supply that city and its suburbs with abundance of the purest water from a sequestered valley high up among the mountains of North Wales, is now approaching its successful consummation. It is the more interesting, because it deals with the primeval features of Nature by a process of artificial restoration, creating once more a lake, which will be the largest in Wales, and not the least beautiful, where Nature, by her own engineering, toward the close of the Great Ice Age, scooped a vast basin in the Silurian rock and made a lake, which afterward, by the rapid disintegration of the rocks, under more severe extremes of temperature than are now experienced, became silted up, and gave place to an alluvial plain cultivated and inhabited by a few villagers. It is now again converted into a greater lake, to be used as a reservoir of water for the supply of a million people dwelling seventy miles away. The population supplied by the Liverpool water works is already 806,000, and will much exceed 1,000,000 soon after the Vyrnwy is made available. Across the intervening country of mountain, woodland, and lowland pastures, the Vyrnwy aqueduct is now completed. "It will be," says Mr. G. F. Deacon, the engineer-in-chief of the works, in his report on the subject to the Corporation of Liverpool, "the longest yet constructed. To the distributing reservoirs at Prescot its length exceeds 68, and to the Town Hall at Liverpool 77 miles—32 miles longer than the famous Claudian aqueduct, and 15 miles longer than the course of the Anio Novus, which, for the last six miles toward Rome, was carried by the same arches as the Aqua Claudia."

The sources of the Vyrnwy are six main streams and many smaller rivulets, rising in mountain moorlands from about 2,200 feet to 1,300 feet above the sea level, and pouring directly into the natural rock basin which has been alluded to. This upland recess, with lofty mountains at its head and hills along both sides, extends nearly five miles in length, and its level bottom is about half a mile wide. It was undoubtedly the bed of a lake, cut out by a glacier, like most of the lakes of Switzerland and of Scotland. The natural bar of harder rock at the lower end of this valley, here a narrow gorge, the lower lip of the ancient lake basin, remains considerably higher than the rock stratum below the alluvial and peat deposit in the valley behind it. Mr. Deacon has been able to use the bar of rock as the foundation of his immense dam of solid masonry closing the lower end of the Welsh valley.

The construction of this dam, which is, we believe, unequaled in some features by any other work of its kind in the world, is worthy of special description. Mr. G. F. Deacon, who succeeded the late Mr. Thomas Duncan as water works engineer to the Liverpool Corporation in 1871, recommended the formation, by damming across the valley, of a lake nearly 5 miles long, draining an aggregate area of 23,200 acres. The level of the lake would be about 817 feet above sea level, and he proposed a course for an aqueduct to Liverpool.

On July 14, 1881, in the presence of an influential company, Earl Powis laid the foundation stone of the



THE GREAT DAM OF VYRNWY LAKE—LIVERPOOL WATER WORKS.

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masonry dam. It has since been carried out by Mr. Deacon solely, as engineer-in-chief.

It has been constructed at Vyrnwy under conditions very similar to those of the Furens reservoir, in France, and of the Karakvasla dam, near Poonah, in India, constructed by General Fife, R.E. The rock bar crossing the lower end of the valley was laid bare by an excavation 1,100 feet long, 120 feet wide, and from 40 to 60 feet below the surface, removing the alluvial deposit of that thickness and the loose bowlders, while the sloping rocks were benched or stepped to make a thoroughly solid foundation for the masonry. The river was diverted, and the building was then begun. The stone of which the dam is built was taken from a quarry about a mile distant, to the north. This stone, like that of the foundation, belongs to the rock strata of the Lower Silurian system. It is a hard, durable, dark gray stone, weighing 2·06 tons per cubic yard, and having a specific gravity of about 2·721. Stones weighing 10 tons were the largest size allowed to be built into the work, but the average weights were: Stones under 2 tons, 45·99 per cent; stones from 2 to 4 tons, 20·86 per cent; stones 4 tons and upward, 33·15 per cent. The lower beds of these stones, if not perfectly flat, were roughly dressed to a plane surface, and any overhanging pieces or undue projections were cut off. They were then washed by jets of water under the pressure of a 140 foot head.

The stone was too hard for pick work; hammer and chisel, or hammer and set, were, therefore, almost exclusively used. When brought to the dam by locomotives and wagons running on a 3 foot gauge railway, they were lifted into position by steam cranes and deposited on a bed of Portland cement mortar. The interstices between the large stones, when important enough, were then built up with smaller ones, around which cement concrete was rammed. On the finished surfaces so obtained fine Portland cement mortar was again spread, in which other similar stones were set and beaten down with heavy malls. No grouting of any kind was allowed, the necessary intimate mixture and density being obtained by ramming. The cement mortar was at first made with cleanly washed sharp river sand, in the proportion of two parts of sand to one of cement. This was afterward abandoned for a mortar made of one part of pulverized rock mixed with two parts of clean river sand, and of this two parts were mixed with one part of cement. From this pulverized stone, sand, and cement a stronger mortar was obtained than from sand and cement only; the mixture also was quite free from "shortness." As the wall was raised the proportion of cement was somewhat diminished.

After Mr. Hawksley retired from the joint engineership, and in consequence of certain statements that he had made, the Liverpool Corporation instituted a scientific inquiry into the stability of the structure and the quality of the materials employed. One of those who then examined it was General Sir Andrew Clark, R.E., then Inspector-General of Fortifications. In the course of the inquiry a vertical shaft was sunk and a heading driven into the heart of the dam. Eleven large blocks of the concrete filling were removed. When tested by Professor Unwin, F.R.S., and Mr. Kirkaldy, they were found to bear, before crushing, an average load of 300 tons per square foot. The masonry was found to be of the highest character, both as to the concrete filling and mortar bedding. Of the cement, the average tensile strength was 6½ cwt. per square inch. Sir Andrew Clark said of this masonry that "nothing short of an earthquake could possibly disturb it."

The total length of this huge masonry dam across the mouth of the valley is 1,172 feet; its greatest thickness at the base is 120 feet; its height, from the lowest part of the foundation to the parapet of the carriage road on the top, is 161 feet, and from the bed of the river or lake, 101 feet; the height from the bed of the lake to the sill for the overflow of water is 84 feet, which will thus be the maximum depth of the lake. The dam has a "batter," or slope, above the level of the ground, to the degree of 1 in 1·5 on the lake side and 1 in 7·27 on the outer side. The total quantity of masonry in this dam is 260,000 cubic yards, weighing 509,700 tons. The illustration is a view of the outer side of the dam, from a sketch taken by our special artist, Mr. W. Simpson, in the autumn of last year, before the rising of the water in the lake, and while the building of arches on the summit, of which there are thirty-three, elliptical in form, with spans of 25 feet, was still in progress. These arches now support a viaduct for the carriage road, 19 feet wide, and two side pathways; also two finely proportioned towers, containing shafts and apparatus controlling the valves in the two tunnels through the dam below, to regulate the compensation discharge of water from the lake to the river Vyrnwy. From the valley below the lake the outer side of the whole structure appears complete, and these two tunnels are seen with the streams of water flowing from them down the valley. Each aperture is 15 feet in diameter; but at present both have been filled up with brickwork and cement, to allow the lake above to fill with water, leaving only, in the center of each tunnel, an iron pipe governed by two valves with the apparatus in the towers, to regulate the outflow of compensation water to the river.

The discharge water to be conveyed by the aqueduct to Liverpool will pass from the lake by a tunnel, and will be first strained through very fine copper wire gauze in the "Vyrnwy Tower."

The Vyrnwy Tower, some three-quarters of a mile distant from the dam, is a very graceful structure, standing in 50 feet depth of water, 140 feet from the shore. The total height of the tower is 160 feet; the outside diameter at the base is 47 feet, which tapers slightly toward the top. The inside diameter is 30 feet 6 inches. The outer casing is of the same gray masonry as the dam, and the inside is built of cement concrete. This tower serves two purposes: it is the point at which the water is drawn from the lake, and serves to supply the aqueduct from near the surface of the lake, whatever may be the level; and within it also all the water is strained clear of suspended organic matter and impurities before it is sent on its course to Liverpool.—*Illustrated London News.*

THE TORPEDO BOAT STILETTO.

BY GEORGE F. W. HOLMAN, LIEUT. U. S. N.

The Stiletto, illustrated in this issue, built at Bristol, R. I., by the Herreshoff Manufacturing Company, was launched February 25, 1885, and was purchased by the government in the summer of 1888 for use as a torpedo boat.

She is a high pressure, single screw, wooden vessel of 31·8 tons displacement to the load water line, 90 feet long between perpendiculars, 94 feet long over all, of 11 feet beam, of 8 feet depth from level of sheer plank, and of 2 feet 10 inches draught.

In her construction lightness is combined with strength. The framing is of white oak, the keel being in two lengths, scarfed and bolted together; the garboards are side-bolted to the keel; and the frames, spaced 15 inches, and extending from the gunwale to the keel, are securely bolted to the latter and to the garboards; plank floors extend across the keel, to which and to the frames they are bolted; the frames are strung together by a thick strake 2 feet above the water line, a top strake, and a gutter strake lapping over the top strake and the ends of the deck beams; the stem and the stern post are of white oak siding. The hull is strapped diagonally with iron straps to prevent working and twisting, those in the wake of the engine room and fire room being of extra strength and crossing in opposite directions. These straps are outside the frames and inside the planking. The deck beams, of oak, are fastened to the frames by malleable iron knees, lightened by holes and bolted through. The side planking is in two thicknesses, butts and seams breaking joints. The inner planks are of white pine, the outer of yellow pine from garboards to the thick strake and of white pine above them. The deck planking is in two thicknesses of white pine. The seams are not calked, but a layer of white lead is placed between the two thicknesses.

The boat is divided by five bulkheads into six watertight compartments. The collision bulkhead is 7½ feet abaft the forward perpendicular. The anchor chain stows in the compartment formed by this bulkhead. The second compartment, 24 feet long, contains the officers' cabin and state-room and the steering gear; the third, 18½ feet in length, is the boiler room; the fourth, 11 feet long, is the engine room; the fifth, 24 feet from bulkhead to bulkhead, contains the galley and the quarters for the crew; and the sixth, 5 feet long, is a store room.

The second compartment is entered through the conning tower, the third, fourth, and fifth by hatchways, and the sixth through a manhole. The fire room hatch cover is fitted with a spring catch, and this, as well as the other covers, can be opened from above or below, and egress is easy in case of accident.

The interior receives light in the daytime through the hatches and through fifteen dead lights on each side. Oil lamps are used at night.

The conning tower, about 4 feet in diameter, rises 2¾ feet above the deck, and has glazed slits for an all-round view. From a platform within, the helmsman has conveniently at hand the steering handles, the apparatus for signaling to the engine room, and the whistle lever.

The boat can be steered by hand or by steam. In the fire room, on the starboard side, is a steam steering cylinder, with a stroke of 24 inches. To its piston are connected two piston rods—a forward and an after one—traveling through stuffing boxes in the cylinder heads. The piston, with its rods, forms, virtually, a part of the starboard wheel rope, the after rod being connected by steel wire rope to the rudder yoke and the forward rod, by wire rope and chain, passing around a fair-leader, to a transverse rack forward of the steering wheel. The port end of the rack is connected, by chain and wire rope passing around a fair-leader, to the port end of the rudder yoke. The steering wheel is attached to a horizontal spindle, the forward end of which bears a small geared wheel. The spindle can be pushed slightly forward or pulled aft in its bearings, and can be locked in either position by a small drop pawl. When pushed forward, its geared wheel engages with the teeth of the rack, and, when aft, it engages with multiplying gearing connected with the rack. The latter position, giving more power to the wheel, is habitually used in steering by hand power alone. The spindle has a slight lateral play in its bearings. Its after end is connected by a system of light rods and bent levers with the valve of the steering cylinder, so that whenever the wheel is turned to starboard or to port, the spindle works to one side or the other, and the valve is moved to open the forward or after steam ports of the cylinder. When rotation of the wheel ceases, the spindle resumes its middle position and the valve is centered. Thus, the steam steering gear is always attached, and it is only necessary to turn on steam to the cylinder when it is desired to use it.

The boiler is a Herreshoff patent square tubular, or coil, boiler, 66 inches square outside and 7 feet high, with ten flats of pipes, 58 inches square, the pipes decreasing in diameter from 3½ inches in the first two flats to 1½ inches in the last two, giving a heating surface of 552 square feet on the inside of the pipes. Weight of boiler, 10,343 pounds. The separator, of wrought iron, is 6 feet high and 18 inches in diameter. Under the cabin is a water tank with a capacity for 200 gallons, joined by piping with one under the boiler and firing flat, holding 300 gallons. A steam injector and a Blake steam pump connect these tanks with the boiler.

In the boiler room is a steam ejector for freeing the compartments from water in case of leaks.

Abaft the boiler, and in the same compartment, is the coal bunker, holding seven tons of anthracite.

There is one furnace, with two doors opening aft. Grate surface, 21 square feet. The ashes pass out by a chute through the bottom. The smokestack is jacketed, the space within the jacket forming an efficient ventilator when working with open fire room.

Forced draught is given by a centrifugal fan, 3½ feet in diameter, driven by an independent engine, 3½ inches by 6 inches stroke.

The engines are vertical direct-acting Herreshoff compound condensing engines, with two cylinders acting on cranks at 90°. Diameter of high pressure cylinder, 12 inches; of low pressure cylinder, 21 inches. Stroke, 12 inches. Weight of engines, 4,275 pounds. The cylinders are supported by eight upright steel rods, 1¼ inches in diameter, rising from the bed plate and reenforced by stay rods and braces. The bed is of steel plate, cut for the cranks, and with lighting holes in the middle. The thrust and engine bearings are attached to this bed and the engine is not otherwise secured to the hull, thus reducing the liability to derangement of the engine to a minimum in the event of damage to the hull. Around the top and bottom of the cylinders are lines of ports controlled by ring valves, the valves at top and bottom being connected by stay rods, and the whole being surrounded by the steam chest and jacketed. Each pair of valves is worked by four stems secured to the lower ring at equal distances apart and connected at their lower ends to a crosshead and a Y-shaped rock shaft attached to the link block. Steam is taken from the center of the valve, and exhausted from the ends. In this engine the cylinder is at all times surrounded by live steam, and is, therefore, always kept at the temperature adapted to the most efficient working. The valves are balanced. The clearance is small, and, as steam is admitted all around the cylinder at once, there is but little wire drawing.

The condenser, of copper, is 5 feet long and 2 feet in diameter, over all, and contains 684 tubes. Water is driven through it by an independent centrifugal pump, making 740 revolutions at full speed.

Six pumps are bolted to the bed plate, worked by reciprocating arms attached to a crosshead on each engine: Two air pumps from condenser to hot well, two feed pumps from hot well to boiler, and two force pumps from separator to boiler.

The shaft is of mild steel, 3⅜ inches in diameter, made in two parts, of a total length of 34⅛ feet, and weighing 1,000 pounds.

The screw, of bronze, is four bladed; diameter, 48 inches; pitch, 80 inches; weight, 250 pounds.

The armament, which the boat is now awaiting, will be Howell automobile torpedoes for attack, and for defense a Hotchkiss revolving cannon, hand grenades, and small arms.

It was originally contemplated to fit the boat with two bow tubes for ejecting the torpedoes ahead, directly in line with keel, but this plan is abandoned in favor of the better one of having a torpedo gun mounted forward, on deck, and capable of train so that torpedoes may be discharged in any direction comprehended within an arc considerably in excess of 180°. The gun and torpedoes are now being made at Providence by the Hotchkiss Ordnance Company.

The enviable distinction belongs to the Stiletto of having made, first, the highest recorded speed for a boat (*a*) of her length and (*b*) of her displacement, over a measured nautical mile course, and, second, the highest recorded speed for a three hour trial for a boat of her displacement carrying a load (in coal, water, crew,

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anchors and gear, and dead weight representing armament) of one-third of that displacement.

Her best recorded run over the measured nautical mile was made in 2 m. 35·2 sec., or at the rate of 23·195 knots, equal to 26·709 statute miles per hour. During this run the pressure in the boiler was 164·5 pounds, intermedial 36·5 pounds, vacuum 19 inches (mercury), air pressure in fire room 3·5 inches (water), horse power, estimated, 560.

During a three hour continuous run at full power she made 59 nautical miles, giving an average of 19¾ knots, equal to 22·646 statute miles per hour. While this run was in progress, time was taken twice over the measured nautical mile course, no notice being given to engineers or firemen, nor any attempt made to spurt the boat, and she was found, from the mean of the two observations, to be making 19·616 knots. Average number of revolutions for the three hours, 388 per minute. Horse power, estimated, 380.

In her contests in speed with other boats she has won a high reputation, trying the issue unhesitatingly with others much superior in size. Her two most notable races have been, one in June, 1885, with the Mary Powell, and the other in July of the same year as a contestant in the American Yacht Club regatta. In the former race, without being pushed to the utmost, she beat the famous Queen of the Hudson by 6 minutes in a run from the foot of West 23d Street to Tarrytown. In the latter race, being entered with the Atalanta, Radha, Cramps, "246," Utowana, and seven others, she made the run from Larchmont to New London in 4 h. 13 m. 31 sec., beating her chief rival, the Atalanta, by 40 m. 19 sec., but not securing the prize, the judges deciding that she had not rounded the buoy at the finish, a fatal technical deficiency, but one of no material consequence whatever as regards the distance or time.

Since her acquisition by the government she has, of course, been entered in no races, but various runs made over the measured mile under varying conditions of load and steam show that she has suffered no diminution of power. She bids fair to live a long and useful life. In her present solitary condition she serves excellently as an instructional boat for officers and seamen. Accompanied by sisters, valuable practice in flotilla evolutions would be possible in peace, and in war the naval contingent, that right arm of our coast defense, would be so much the more muscular. First class or sea-going torpedo boats should compose our flotilla of the future, capable of operating in all weathers and with a large radius of action. Second class boats, among which the subject of this article is rated, are of chief value in defense of harbors and of inclosed waters, and will be able to serve, in other than very stormy weather, in operations extending to about two hundred miles from the coast.

Five tons of coal will drive the Stiletto 112 knots at a speed of 18 knots per hour, and 515 knots at a speed of 11 knots per hour. Each ton of coal additional will increase the mean draught ¾ inch and will add about 20 knots to the former distance and 100 knots to the latter.

In a rough sea test, to ascertain the strength of the boat and its qualities in heavy weather, remarkably good behavior was manifested. The boat rolled but little when put in the trough of the sea and, steaming head on, spray alone came aboard, no solid water being shipped. The distance run was 41·17 knots and it was made in 2 h. 22 m. 41 sec. giving an average of 17·31 knots, equal to 19·93 statute miles per hour.

Our illustrations give, Fig. 1, a view on deck looking forward; Fig. 2, the interior of the conning tower; Fig. 3, a view on deck looking aft; Fig. 4, the after part of the quarters for the crew; Fig. 5, the boat as seen from astern; Fig. 6, the helmsman at his post and the officers' stateroom; Fig. 7, the engine room; Fig. 8, the boiler room; Fig. 9, the galley; and Fig. 10, a broadside view of the boat.

The Stiletto, aside from the beauty of her model and the wonderful record achieved, and beyond the admiration evoked by the striking originality of her component parts, to the harmonious working of which her success is due, excites particular interest from the fact that she is the first torpedo boat designed for the use of automobile torpedoes ever owned by the United States.

The government has, up to a recent date, relied mainly on spar torpedoes for use in torpedo warfare. Nearly all our monitors, a few of our tugs, and all of our ships, from the close of the civil war to the beginning of the present era of "the new navy," have been fitted with them, and each ship has been and still continues to be furnished with at least one steam launch provided with means for operating them.

With the exception of these launches, we have owned but few torpedo boats, properly so designated, and of these few but one, prior to the acquisition of the Stiletto, has been distinguished for speed. The first, a plunging torpedo boat, built from the designs of a Frenchman at an early period of the civil war, attained a speed, under sixteen oar power, of 2½ knots. Her torpedo, affixed to the hull of an enemy by a man in a diving suit emerging from the interior of the boat, was to explode, after an interval, through the action of clock work contained within it. This boat, an utter failure, foundered at sea. The next was the Spuyten Duyvil, built toward the close of the civil war, carrying an under-water spar ahead. Speed low. She is no longer on the navy list. The Intrepid, built in 1874, was the third, fitted at first with a submerged spar and later with towing torpedoes and with ordinary above-water spars on either beam. Speed between 10 and 11 knots. Proving a failure as a torpedo vessel, she is now being converted to a light draught gunboat. In 1874 was also built the torpedo ram Alarm, carrying a spar torpedo ahead and one on either beam. Speed 11 knots. She is now in ordinary at New York. In 1875 the Lightning was built by the Herreshoff Manufacturing Company for the Bureau of Ordnance. This boat attained a speed of 20⅓ statute miles, equal to 17⅔ knots, a record which has never been equaled by any boat of her length, 58 ft. She is now hauled up at the torpedo station, worn out in service.

The high efficiency realized by the Lightning and the Stiletto gives cause for belief that a new and larger steel torpedo boat, now building by the Herreshoff Manufacturing Company, under contract with the government, will yield results which will do this enterprising firm credit when the time for her trial arrives. It is to be hoped that other boats may follow soon and that, while other nations are building by dozens and by scores, our government may see the wisdom of increasing these valuable adjuncts of the naval force more rapidly than by occasional units.

Flying Fish.

At a recent meeting of the Physiological Society, Berlin, Prof. Moebius spoke on the movements of the flying fish through the air. He first described, from personal observation, the way in which the fish shoot out of the water from both bows of the ship, and then propel themselves horizontally for a distance of several ship's lengths with their pectoral and abdominal fins stretched out flat, skimming along without moving their fins, always in the direction of the wind, but either with or against the same. When they meet the crest of a wave they raise themselves slightly in the air, falling again to the same extent in the succeeding trough of the sea. Occasionally a slight buzzing of the fins may be observed, similar to that of the movements of the wings in many insects. At night they frequently fall on the deck of the ship.

As a result of a detailed investigation, the speaker had proved that these fish do not fly, since the anatomical arrangements of their fins and muscles are not adapted to this purpose. What really occurs is that when frightened by the approach of a ship or any enemy they shoot up out of the water, as do so many other fish, and are then carried along by the wind, which strikes on the under surface of their outstretched and evenly balanced fins. Notwithstanding the general acceptance which was accorded to the above investigation, it was urged by many that the buzzing of the fins, the rising over the crest of a wave, and the falling overboard after having landed on the deck of a ship, were evidences that this fish really executes movements which result in flight. In reply to this, the speaker pointed out that the buzzing of the fins takes place when a strong current of air is directed against the outspread fins of a dead flying fish by means of a bellows, and further, that the rising over the crest of a wave or the bulwarks of a ship may be explained by the ascending currents of air which are always produced whenever a strong horizontal wind strikes against any elevated object, such as a wave or part of a ship. Thus, finally, with the exception of the movements involved in its oblique sudden exit from the sea, all the motions of a flying fish when in the air are really passive.

Explosive Silver and Iodine Compounds.

An imperfect argentine fulminate, although one of a violently explosive character, is prepared by digesting recently precipitated oxide of silver in ammonia for twelve hours, then pouring off the liquid and cautiously drying the black powder in the air, having previously divided it into small portions. This is a most violent explosive, but not quite so much so as some crystals which are obtained from the ammoniacal liquid that was decanted. This liquid, after being gently heated, deposits, on cooling, small crystals which will scarcely bear touching, even while under the liquid. A modification of this consists in dissolving chloride of silver in ammonia, adding caustic potash in fragments, and when effervescence ceases decanting the fluid portion and washing and drying the powder. These were known as Berthollet's fulminating silver, although they are not now considered to be a true fulminate of silver, being simply oxide of silver and ammonia.

The true fulminate is formed by adding alcohol to a warm solution of acid nitrate of silver. We give a formula for its preparation on the principle upon which sunken rocks are marked on the mariner's chart, viz., as something to be avoided when experimenting with chemicals in everyday use. Pour one ounce of alcohol over one hundred grains of powdered nitrate of silver, and add an ounce of nitric acid. When the nitrate assumes a white, cloudy appearance, cold water is added to suspend the ebullition, and the powder is collected on a filter and divided into small portions. This is Brugnatelli's method; but those of Fownes and Liebig differ from it in no important respect. For example, the latter dissolves one part of metallic silver in ten parts of nitric acid, and then pours the solution into twenty-three parts of alcohol. This is heated to the boiling point, and is set aside to cool, when the fulminate is deposited in white, lustrous, acicular crystals, the weight of which, after being washed, equals that of the silver originally employed.

From the foregoing it will be seen how near to the wind photographers may sail without running foul of this most deadly compound, which only a few years ago was stated to be the most dangerous substance for which we are indebted to modern chemistry. It is certainly still the most dangerous of those cognate to photography, not excepting the iodide of nitrogen, a substance which at one time was recommended as giving a remarkable degree of sensitiveness when employed in photography. Indeed, in the earlier times, even the fulminates, not only of silver, but of the other metals, were suggested as being likely to possess marvelous sensitive-conferring properties. Friction or percussion are stated as means whereby the explosion of fulminating silver is effected, but such friction and percussion need be only very slight indeed—a touch of a feather and the fall of a drop of water upon the compound have been known to do the mischief.

We have alluded to iodide of nitrogen. We feel it to be a duty to refer to the fatal facility with which this substance can be formed. A few crystals of iodine placed in a capsule, with enough ammonia poured over it to effect its solution—and that is all. The compound arising from this simple mixture is the deadly ter-iodide of nitrogen. Such a mixture has been recommended, and is employed by many, for removing pyro stains from the fingers. When used aright, it is quite harmless, the condition of safety being found in there being an excess of the iodine. This solution was stated by the late Rev. J. B. Reade, F.R.S., at that time president of the Royal Microscopic Society, to form an agent in dissolving gold under circumstances valuable and interesting to microscopists. A drop is placed upon a microscopic slide, and a bit of gold leaf is laid thereon; this dissolves and forms beautiful tree and shrub like growths of bright gold.

When photographers feel it incumbent on them to use iodide of nitrogen, they ought to take special care not to allow it to be placed aside where it will dry and crystallize, as in this form it cannot bear to be touched. Even the very act of throwing it away may lead to its exploding ere it is projected into the waste.—*British Journal of Photography.*

334 Rounds in 27 Seconds.

Some interesting experiments were made recently near Dartford with the Maxim Nordenfelt quick-firing and automatic guns. The first weapon fired was the Maxim automatic gun of 0·45 caliber, and with this 334 rounds were fired in twenty-seven seconds. A comparative test was then made between ordinary rifle powder and the new Maxim smokeless powder. A cartridge containing 85 grains of black powder and others containing 55 grains of the new powder were fired. The last mentioned cartridges gave a slightly greater velocity, and at the same time produced extremely little smoke. Among the other guns tried was an automatic six pounder, which has a dropping block like the Sharpe's rifle. It requires only two men to work it, one firing and the other loading. Everything about the gun is fixed save the gun itself, which is placed inside a jacket, which latter is also fixed. There can be no danger of escape of gas or from a hang fire. The gun on being fired recoils about 4½ inches, and then returns to its original position. The cartridge case is not ejected till the gun has traveled some little distance on its return journey. The act of putting in the new cartridge pushes forward the ejectors and releases the block, which rises and closes the breech. If great rapidity is required, one man on a saddle with a butt to his shoulder aims and fires, while a man on each side puts in the cartridges. If only one gunner is left unkilled, a single man can work the gun in the following manner: Having laid the gun and fixed the trigger in a firing position by a bit of wood or string, he simply puts in cartridge after cartridge, the gun on each occasion going off as the cartridge is pushed forward. It can be fired, with two men to load, sixty times a minute.

Ingenious Mode of Advertising.

The agents for a certain kind of cough candy distribute circulars on which is stated the following puzzle: "What number can you take, and when you divide it by two, three, four, five or six you will have one over, but when divided by seven nothing will remain?" The circular goes on to say that if a person cannot solve the puzzle he should buy a box of the candy, when the agent will hand him the right number on a slip of paper. The methods of advertising are not yet all exhausted.

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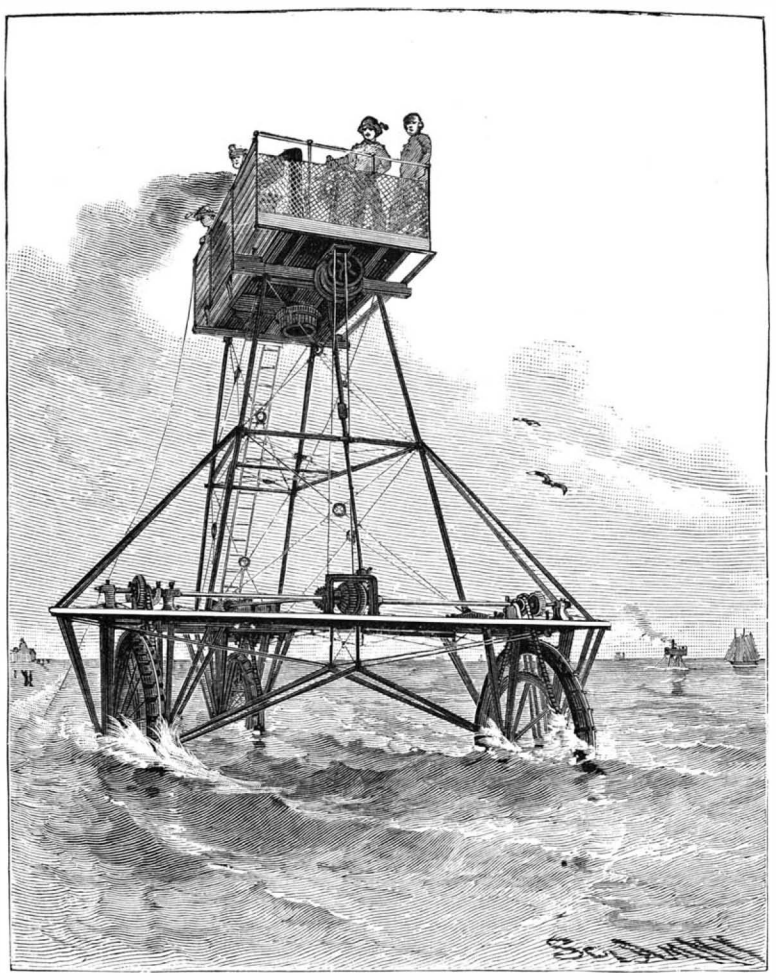
LAKE'S OCEAN TRICYCLE AT ATLANTIC CITY, N. J.

The illustration shows a vehicle designed to cause somewhat of a sensation in the world under the waters as well as above. The ocean tricycle, as it is called, consists of a high platform carried on an iron framework, the whole resting on three wheels. The peripheries of the wheels have slight projections cast upon them similar to those on the driving wheels of mowing machines. These wheels are turned by a steam engine placed upon the upper platform and as they turn drive the machine over the smooth sandy bottom near the shore.

The engine, with its boiler, is placed well above the reach of spray. As it works it turns a vertical shaft that descends within the framework. At its lower end the shaft actuates miter gearing so as to turn shafting running to points over the main wheels. On the one shaft with each driving wheel is a sprocket wheel of about two-thirds the diameter of the driver. Chains go around these wheels, and around much smaller sprocket wheels, one on each of the horizontal driving shafts, thus completing the connection between engine and drivers. It will be noticed that the three wheels are driving wheels, so that there can be no slip. On the platform is placed a steering wheel, by which the course of the vehicle is regulated at pleasure. There is also room for a number of passengers on the same platform.

Owing to the light construction of the framework, the wind and waves will have very little effect upon the machine, and we doubt not that the inhabitants of Atlantic City will have many enjoyable rides on this machine over the level ocean bottom that exists there. One very pleasing feature is the height above the water at which the passengers are carried. On a quiet day the view of the bottom will disclose many of its features, otherwise invisible, such as variations in color, depth, beds of seaweed, etc., exactly as the same can be seen from the masthead of a sail boat when lying in still shallow water.



LAKE'S OCEAN TRICYCLE AT ATLANTIC CITY, N. J.

CHINESE ALLIGATORS IN THE AQUARIUM AT BERLIN.

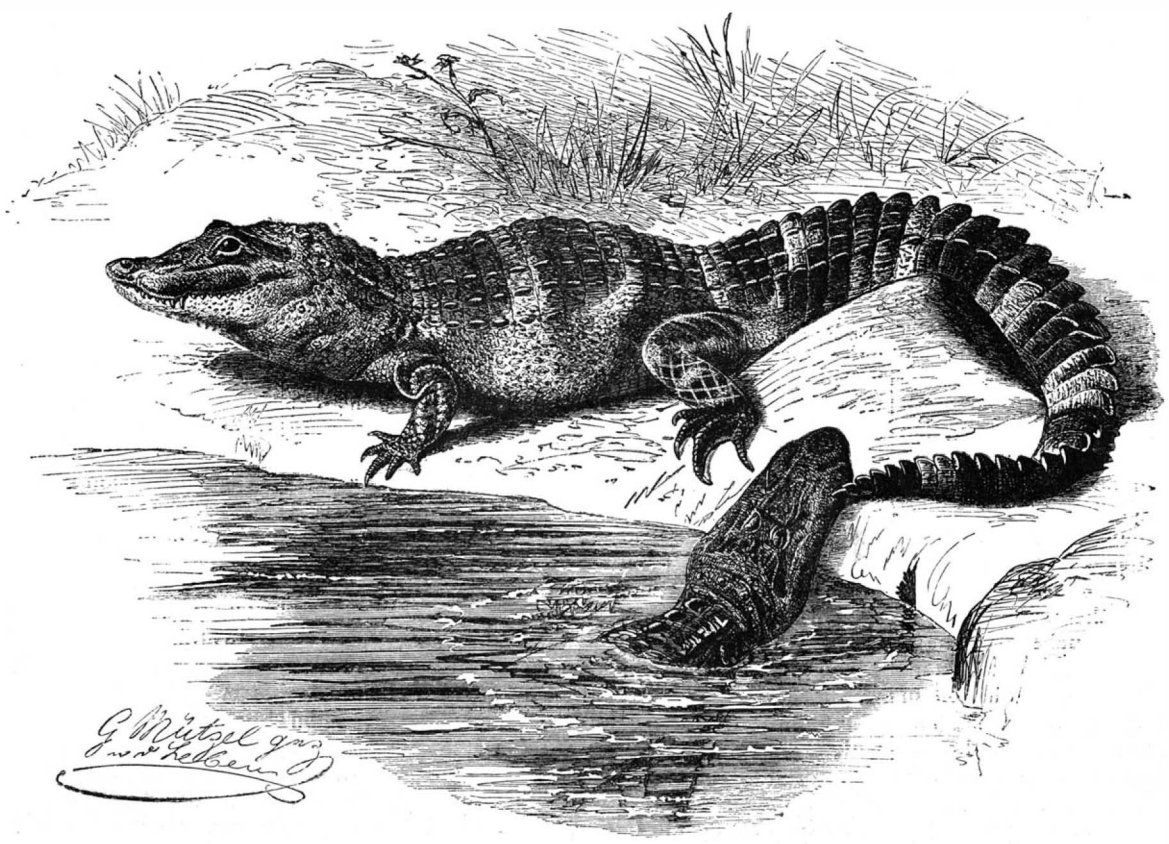
To the casual observer, crocodiles bear such a strong resemblance to one another that it is difficult to distinguish the various species, especially as they differ so little in coloring and in habits when in captivity. Still, there are about twenty known species, which are divided into three families distinguished by the shape of their jaws, viz.: the gavial, the crocodile proper, and the alligator.

While the gavial is found only in Asia, and, heretofore, the alligator only in America, the different species of crocodile inhabit all parts of the world except Europe, being found within a belt 70° wide and extending half to the north and half to the south of the equator.

The great Chinese empire is so situated geographically as to include the home of the crocodile, but, owing to the exclusion of all foreigners from the country, there has been, until recently, no proof of the existence of these creatures in the rivers of China. The oldest Chinese writers told of wonderful animals called "To," "Go," and "Ngo," which can only be explained by crocodiles. The skins of the captured animals were sent as great curiosities to the imperial court, and were there used in making great drums. In the "Pentsao-kang-mu," of the materia medica, it is stated that the inhabitants of Southern China eat the flesh of the alligator at wedding feasts. We are also told by Han-Wen-Kung that in response to a petition from the natives of the Province of Chauchu, the Emperor sent troops to rid the region of dragons. These and similar stories of other Chinese authors were first repeated to Europeans by Marco Polo, the Venetian, who visited China in the latter part of the thirteenth century, but he had these things only from tradition, for neither he nor Martini (who gave us gleanings from the Chinese classics in his "Atlas Sinensis") ever saw a crocodile. From the same sources we learned that crocodiles in ponds were cared for by the priests of the neighboring temples and criminals were thrown to them, this mode of execution being considered a "judgment of God." It can easily be understood that many proverbs, superstitions, and stories of wonderful adventures would be connected with these animals. The next information came to us after many hundred years. None of the many exploring expeditions found any traces of the crocodile; but finally in 1869 Swinhoe saw a living specimen four feet long exhibited in Shanghai. On April 15, 1878, the Shanghai museum came into possession of a specimen, in which the curator was surprised to find an alligator of a species supposed to be confined to America. He called it "Alligator sinensis."

In 1888 the German consul at Shanghai obtained three living specimens of this natural curiosity and sent them to Prince Bismarck, who assigned them to the Berlin Aquarium, where they are still.

The largest of these animals measures about 5½ feet in length and the other 4½ feet. The third was, unfortunately, dead when it reached Genoa. They came from the Province of Chekaing, where they were caught in a pond near the Tien-mu Mountain.—*Illustrirte Zeitung.*



CHINESE ALLIGATORS IN THE AQUARIUM AT BERLIN.

Paris Exhibition Regulations for Photographers.

Article First.—The right to take photographic views in the Universal Exhibition of 1889 will not be made the object of any monopoly or exclusive privilege. All photographers permitted, on application, to take pictures within the exhibition limits, and upon the days and hours fixed by the administration, must be provided with an authorization, signed by the director-general of the "Exploitation." For that which concerns the fine arts group (classes one to five) the authorizations must be signed both by the fine arts director and by the director-general of the exploitation.

Article Second.—Photographers authorized under article 1 of the present regulation will work at fixed times. For each of these admissions a payment of twenty francs (sixteen shillings), to go to the administration, must be made for each apparatus employed. This payment must be made and receipted in the cashier's office at the exhibition. The admissions will have a duration of four hours: either from eight in the morning until midday, or from ten in the morning until two in the afternoon. All authorizations will be valid only for the days and hours indicated. The director-general of the exploitation will always have the power of renewing them, without additional payment, if they have not been used on the days and hours fixed.

Article Third.—Applications for authorizations addressed to the director-general of the exploitation must state: 1. The number of assistants the applicant intends to employ. 2. A statement of what apparatus he intends to use. 3. A formal declaration that the applicant takes the whole responsibility of any consequences his reproductions may entail. 4. An undertaking to conform to the police regulations and the rules of the interior.

Article Fourth.—Season tickets at the price of 300 francs for each piece of apparatus employed, available during the whole term of the exhibition, at the hours fixed by article 2, will be issued to those photographers who apply for them.

Article Fifth.—Assistant operators, like the operators themselves, must pay the same entrance fee as ordinary visitors, in addition to the sum paid for authority to photograph.

Article Sixth.—Operators admitted to photograph must not, under any circumstances, introduce within the exhibition fire or explosive or inflammable substances. Their preparations must be made outside the limits of the exhibition.

Article Seventh.—All reproduction of objects exposed, whatsoever be the nature of the said objects, is absolutely subject to permission being given by the exhibitors thereof or their authorized agents, countersigned by the director-general of the exploitation.

Article Eighth.—Photographers furnished with authorizations have the right to take general views of the palace, parks, and galleries, on condition that they send ten proofs of each view to the administration.

Preferred Creditors.

Medical men in general are probably not aware that in France the doctor's claim on the estate of a deceased patient has precedence of all others. Even the landlord's claims for arrears of rent must yield to the doctor's fee. The courts have decided that as it is an imperative right of humanity that the dying should have the necessary care and treatment, such attendance should be paid for before all the other debts. Such a law in this country would be hailed with satisfaction by the doctors, and a similar provision for the undertakers would delight that profession.

THE Boston *Herald* says that one-third of Boston is now resting on spruce stilts, some 112 ft. long, though in ordinary cases a length of 30 ft. is sufficient. But in certain localities "mud holes" occur which require piles of over 100 ft. in length to reach firm bottom. The piles lately driven at Ruggles and Westminster streets were made up of hard pine sticks 10×10 in. square and 42 ft. long. The sections were spliced by banding both ends and inserting an iron plate and completing the splice with four pieces of oak, 2×10 in. An 1,800 pound hammer was used in driving.

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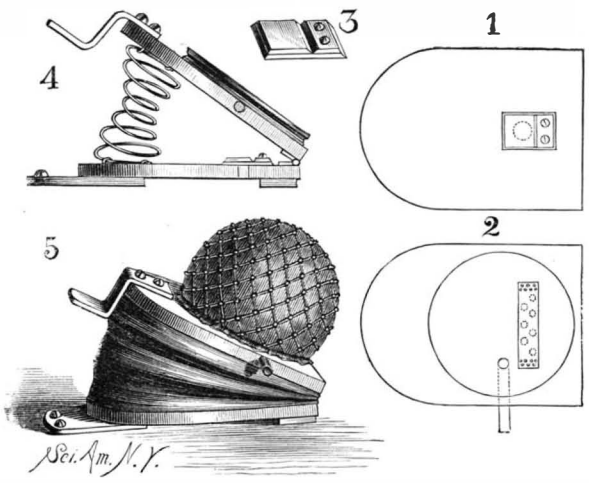
APPARATUS FOR SOLDERING AND MELTING.

BY GEO. M. HOPKINS.

No laboratory is complete without an efficient blowpipe and some means for operating it; and while it is, as a rule, advisable to purchase apparatus of this class rather than make it, a few hints on the construction of a bellows, a blowpipe, and a small furnace may not be out of place. The bellows and furnace are of the kind devised by Mr. Fletcher, and made by the Buffalo Dental Mfg. Co. The blowpipe differs in some respects from those furnished by the above-named house.

In the construction of the bellows the following materials are required: Two hardwood boards 10 × 11 inches and ⅞ inch thick; one circular board 1 inch thick and 9 inches in diameter; one piece of heavy sheepskin 30 inches long, 7 inches wide at the middle, and tapering to two inches at the ends; two disks of elastic rubber, each 11 inches in diameter and $\frac{1}{32}$ inch thick; one small scoop net; 3 inches of ⅜ brass tubing; 3 small hinges; a spiral bed spring, and two iron straps.



Figs. 1 to 5.—BLOWPIPE BELLOWS.

The 10 × 11 inch boards are rounded at the ends, as shown in Figs. 1 and 2, and their square ends are connected together by the hinges as shown in Fig. 4. A hole is made in the lower board near the hinged end and covered by the valve shown in Fig. 3. The valve consists of a soft piece of leather, having attached to it two wooden blocks, one of which is fastened to the board in position to hold the other in the position of use. These blocks are beveled so as to give the valve sufficient lift and at the same time limit its upward motion. The circular board has a groove turned in its edge, and in a hole formed in its edge is inserted the brass tube. A hole is bored into the top of the circular board, which communicates with the inner end of the brass tube, and a series of holes are made in the circular board, which also pass through the upper board of the bellows. Over these holes is placed a strip of soft, close-grained leather, which is secured by nailing at the ends. This leather strip forms the upper valve.

The bed spring is secured to the upper and lower boards, and the bellows is ready to receive its covering. The spring, the hinges, and the valves should be secured with great care, as they are inaccessible when the leather covering and the rubber disks are in place. The boards are closed together, reducing the space between them to about 5½ inches. They are held in this position in any convenient way until the cover is attached. The leather covering is glued, and tacked at frequent intervals. The leather is carried around the corner and over the hinged ends of the boards. An additional piece of leather is glued over the hinged end, and a narrow strip of leather is glued to the edges of the boards to cover the tacks and the edges of the leather covering. The job will be somewhat neater if the edges of the boards are rabbeted to receive the edge of the covering and the tacks.

The rubber disks are stretched over the circular board and secured by a strong cord tied over the rubber and in the groove in the edge of the board. The net is afterward secured in place in the same way. The net should be so loose as to allow the rubber, when inflated, to assume a hemispherical form, as shown in Fig. 5. A cleat is attached by screws to the hinged end of the lower board, and a straight iron strap is attached to the rounded end of the same board. The corresponding end of the upper board is provided with an offset strap, upon which the foot is placed when the bellows is used. The hole closed by the lower valve is covered by a piece of fine wire gauze tacked to the under surface of the lower board to prevent the entrance of lint and dust.

The blowpipe, which is connected with the brass tube of the bellows by means of a rubber pipe, is shown in section in the upper part of Fig. 6. It consists of two pipes attached to each other and adapted to receive the rubber pipe connections at one end. At the opposite end they are arranged concentrically, the aperture of the smaller pipe—which receives the air—being reduced 0·05 of an inch. The outer and larger pipe, which receives the gas, is provided with a sliding nozzle, by means of which the flow of gas can be easily controlled. The internal diameter of the smaller end of the nozzle is one-quarter inch. These dimensions are correct only for a blowpipe for small and medium work, *i. e.*, for brazing or soldering the average work done in the making of physical instruments; for melting two or three ounces of gold, silver, brass, and other metals, and for forging and tempering tools and small articles of steel, and for glass blowing on a small scale.

The gas is taken from an ordinary fixture by means of a rubber tube, the supply being regulated entirely by the movable nozzle of the blowpipe. The force of the blast varies with the manner in which the bellows is operated.

One of the best supports for articles to be brazed or soldered is a brick of pumice stone. It heats quickly, is very refractory, it admits of securing the work by tacks or nails driven into it. It has the further advantage of being incombustible. The work to be brazed or soldered must be well fitted, *i. e.*, there must be a good contact between the abutting or overlapping edges, and the contact surfaces must be well painted with a cream formed by grinding borax with a few drops of water on a slate (Fig. 7). When necessary, the work may be held together by an iron binding wire. The solder is coated with the borax cream before it is applied to the joint. For most work silver solder is preferred, as it is very strong, being both ductile and malleable.

Fig. 7.—GRINDING BORAX.

Fig. 9.—INGOT MOULD.

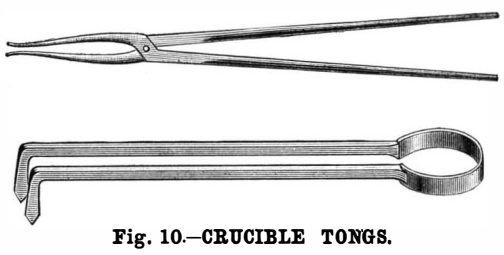


Fig. 10.—CRUCIBLE TONGS.

The work is heated gradually until the water of crystallization is driven from the borax, then the work is heated all over until the solder is on the point of melting, when a concentrated flame is applied to the joint until the solder flows. Care should be taken to use the reducing flame rather than the oxidizing flame. Should it be found difficult to confine the heat to the work, pieces of pumice stone may be placed around the part containing the joint, as shown in Fig. 6.

A large number of small articles may be easily and quickly soldered by placing them on a bed formed of small lumps of pumice stone and proceeding from one article to another in succession.

For supporting small work, having a number of joints and requiring much fastening, the slabs of asbestos are very desirable. For very small work to be done with the mouth blowpipe, the prepared blocks of willow charcoal are used.

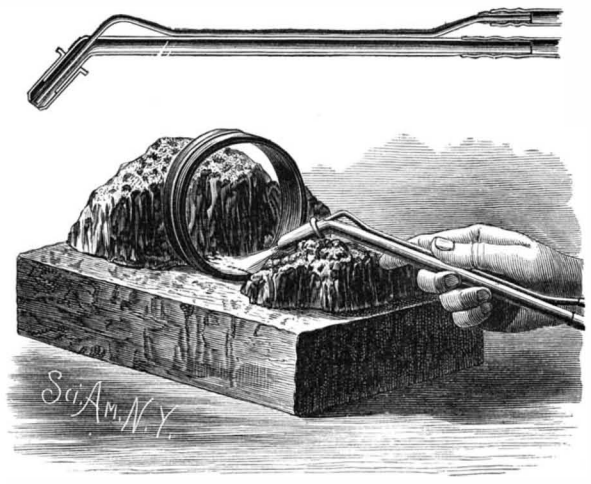


Fig. 6.—BRAZING.

After soldering the borax may be removed by boiling the article in sulphuric acid.

The small gas furnace shown in Fig. 8 may be used in connection with the blowpipe and bellows, already described, by arranging the blowpipe on a stand and placing the furnace upon the pumice stone brick or a fire brick. The blowpipe is adjusted to deliver a blast to the opening of the furnace. The crucible in which the metal is melted rests upon an elevation at the center of the furnace, as shown in the sectional view in Fig. 8. The crucible contains besides the metal a small quantity of borax for a flux. A roaring flame is required, and the blowpipe must be carefully adjusted with reference to the opening of the furnace to secure the best results. With this furnace and blowpipe two ounces of metal can be melted in ten minutes. Its capacity, however, is greater than that. After the metal is rendered sufficiently fluid it may be poured into an oiled ingot mould, shown in Fig. 9, thus giving it a form adapted to rolling or hammering, or it may be poured into a sand mould, giving it any desired form. The crucible is handled by means of the tongs shown in Fig. 10.

The body of the Fletcher furnace is formed of clay treated in a peculiar way to render it very light and porous. It is 4¼ inches in external diameter and 4¼ inches high. Its internal diameter at the top is 2¾ inches, at the bottom 2¼ inches. The hole at the side is ¾ inch in diameter. The cover, which is 1½ inches thick and of the same diameter as the body, is concaved on its under surface and provided with a ⅝ inch central aperture. The cover and the body are encircled by sheet iron.

It is not difficult to make a furnace which will compare favorably with the original article. Any tin or sheet iron can of the right size may be used as a casing for the furnace, provided it be seamed or riveted together. A quart wine bottle having a raised bottom serves as a pattern for the interior of the furnace. The upper portion of the raised bottom is filled in with plaster of Paris or cement to give the crucible support a level top. The material used in the formation of

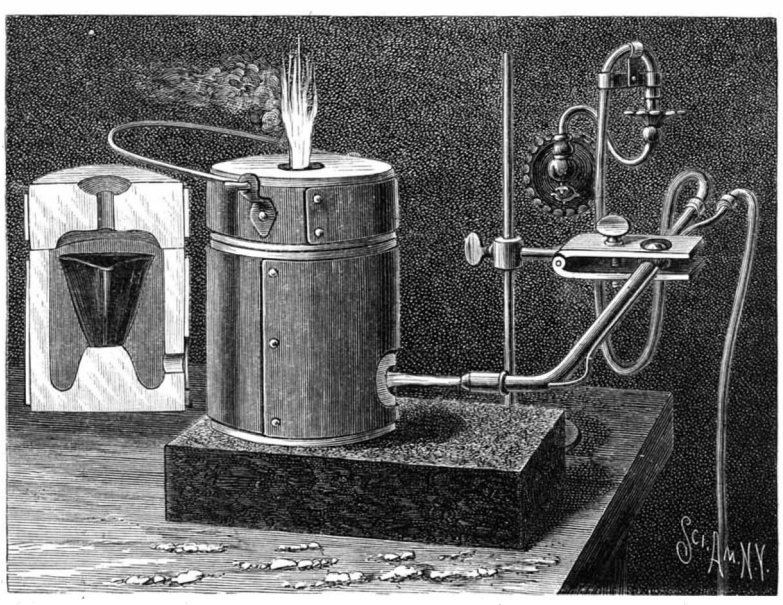


Fig. 8.—BLOWPIPE FURNACE.

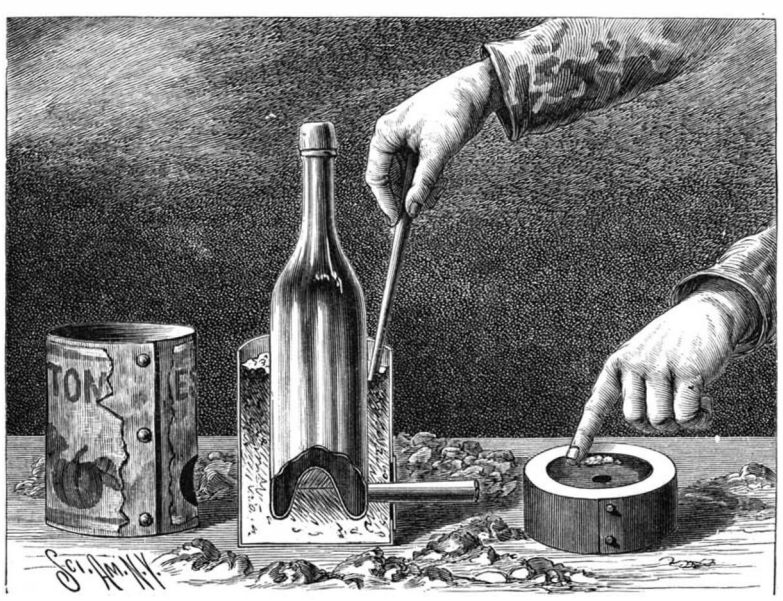


Fig. 11.—MAKING A BLOWPIPE FURNACE.

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the furnace is clay of the quality used in the manufacture of fire bricks, or even common bricks, moistened and mixed with granulated fire brick. The material known as "stove fix," used in repairing the lining of stoves, answers very well when mixed with granulated fire brick or pumice stone.

The can is filled to the depth of an inch with the material. The chambered bottom of the wine bottle is oiled and filled with the material and placed in the can as shown in Fig. 11. A ¾ inch wooden plug is inserted in a hole in the side of the can, to be afterward withdrawn to form the blast aperture. The can is then filled with the clay mixture, which is tamped in lightly. The material should not be too wet, and it is well to oil the bottle to facilitate its removal. When the filling operation is complete, the bottle is loosened and withdrawn. The cover is formed by filling a suitable band with the clay mixture. The furnace is allowed to dry for a day or so. The first time the furnace is heated, the temperature should be increased very gradually.

Cure of Inebriates.

From the *Quarterly Journal of Inebriety*, published at Hartford, Conn., under the auspices of the American Association for the Study and Cure of Inebriates, we make the following extracts from a recent lecture by Dr. Elliott, at Toronto:

Four conditions must be observed. The first condition of cure and reformation is abstinence. The patient is being poisoned, and the poisoning must be stopped. Were it an arsenic instead of an alcohol, no one would dispute this. So long as the drinking of intoxicants is indulged in, so long will the bodily, mental, and moral mischief be intensified and made permanent. Abstinence must be absolute, and on no plea of fashion, of physic, or of religion ought the smallest quantity of an intoxicant be put to the lips of the alcoholic slave. Alcohol is a material chemical narcotic poison, and a mere sip has, even in the most solemn circumstances, been known to relight in the fiercest intensity the drink crave which for a long period of years had been dormant and unfelt. The second condition of cure is to ascertain the predisposing and exciting causes of inebriety, and to endeavor to remove these causes, which may lie in some remote or deep-seated physical ailment. The third condition of cure is to restore the physical and mental tone. This can be done by appropriate medical treatment, by fresh air and exercise, by nourishing and digestible food given to reconstruct healthy bodily tissue and brain cell, aided by intellectual, educational, and religious influences. Nowhere can these conditions of cure be so effectually carried out as in an asylum where the unfortunate victim of drink is placed in quarantine, treated with suitable remedies until the alcohol is removed from his system, then surrounded by Christian and elevating influences, fed with a nourishing and suitable diet, and supplied with skillful medical treatment. His brain and nervous system will then be gradually restored to its normal condition, and, after a period of from six to twelve months in most cases, he will be so far recovered as to be able to return to his usual avocation and successfully resist his craving for drink. The fourth condition of cure is employment. Idleness is the foster mother of drunkenness, industry the bulwark of temperance. Let the mind of the penitent inebriate be kept occupied by attention to regular work, and the task of reformation will be shorn of half its difficulty.

Age of Parents and Vitality of Children.

Mr. J. Korosi, director of the Hungarian Bureau of Statistics, recently read a memoir before the Hungarian Academy of Sciences upon the "Influence of the Age of Parents upon the Vitality of Children," and in which, taking 24,000 cases as a basis, he reaches the following conclusions:

Children whose father is less than 20 years of age have a weak constitution. The issue of fathers of between 25 and 40 years are the strongest, while the descendants of fathers of over 40 years are weak. The healthiest children are those whose mother has not yet reached 35 years. Those born of mothers of between 35 and 40 years of age are 8 per cent weaker, and those of mothers of over 40 are 10 per cent weaker. The children of aged fathers and younger mothers have, as a general thing, a strong constitution; but if the parents are of the same age, the children are less robust.—*Revue Scientifique.*

The Argentine Republic.

E. L. Baker, United States consul at Buenos Ayres, has in the Consular Report for February, 1889, a very interesting and lengthy report on the Argentine Republic, its products and resources, showing its importance to our business people as a market for our products. Referring to the newspapers received at the consulate, Mr. Baker mentions the SCIENTIFIC AMERICAN and others which he has placed at the disposal of merchants, shippers, etc., believing that they have been the source of great benefit to those interested in trade and commerce.

Correspondence.

Cement for Aquariums.

To the Editor of the Scientific American:

J. C. M. in Notes and Queries No. 634 says: "An aquarium of mine, made of marble and glass, leaks at the joints." I have a very large one, and have experimented with many cements and putties. I find the following perfectly satisfactory:

	By measure.
Whiting	6 parts.
Plaster of Paris	3 "
White beach sand	3 "
Litharge	3 "
Powdered resin	1 "
	16 parts.

Mix the ingredients together thoroughly, then make into a putty with the best coach varnish. Only enough to set one glass should be made up at once, as it soon becomes too hard to work. The glass should be thoroughly bedded in the putty and left about a week to harden. Cover the joints with two coats of asphaltum. Cover over on to the glass. This will stand water for an indefinite period, and if properly done, will not leak. HARRY S. WOODWORTH.

Rochester, N. Y.

Formation of Gas in Hot Water Pipes.

To the Editor of the Scientific American:

In regard to the article on the formation of gas in hot water and steam pipes, mentioned in your issues of March 30 and April 13, if no other conditions are present than those mentioned in the several cases, it would seem clear that the gas is hydrogen.

One of the common ways of making this gas in the laboratory is to pass steam through a hot iron pipe, the oxygen of the water (steam) uniting with the iron, forming iron oxide or iron rust, thus setting free the hydrogen. Whenever rusting, which is accompanied by heat, takes place *under water*, there is some hydrogen set free by the chemical action. The interior surface of cast iron is more or less rough, which would facilitate chemical action.

The entire surface exposed to the action of water or steam would be considerable, so that the total amount of gas which might form, though but a very little came from each square inch of iron, would in time form quite a volume of gas. This action would be more rapid in new pipes than in old ones, and also in case the pipes were very hot. CHAS. E. ADAMS,

Teacher of Science, State Normal School.

Salem, Mass., April 22, 1889.

The Gas Check for Heavy Ordnance.

To the Editor of the Scientific American:

I notice in your No. 13, March 30, SCIENTIFIC AMERICAN, in an article headed "War Material of American Designing," that credit is given to Colonel Broadwell for inventing the gas check now used by Krupp and others. I am in doubt about Broadwell being the original inventor of a gas check of this kind, viz., where a ring or its equivalent is inserted in the sliding block having a chamber behind it, into which the gas enters and forces the ring against the end of the barrel when the explosion takes place.

I recollect very distinctly in 1855 or 1856 being shown this improvement by Mr. Hezekiah Conant; the cause that prompted this improvement being the leakage of gas between the breech slide and the end of the barrel in the Sharpe rifle. Mr. Conant was at that time employed at the Sharpe's rifle factory, and he showed me his invention in a rifle, which we tested. It made a thoroughly tight joint, and was considered perfect. It was adapted and applied to all the Sharpe rifles made afterward up to the time the metallic cartridge was put into use. I feel quite sure that Mr. Conant was ahead of Broadwell in using the pressure of gas to close the joint between the sliding breech and end of barrel. Several years after this Broadwell's check was adopted in Germany in large guns, and the writer, when at the German armories in 1873, saw them being made at that time and gave them a history of the invention.

Of course the improvement is public property now, but I have felt since Broadwell came out with his patent that Mr. Conant was the man who should have the credit of the invention. "Honor to whom honor is due!" See Conant patent, April 1, 1856, No. 14,554.

F. A. PRATT.

Hartford, Conn., April, 1889.

[The use of expanding devices in breech-loaders to prevent escape of gas dates back of Mr. Conant's patent, and is so stated by Mr. Conant himself, for in his patent above cited, he refers to examples, namely, Green's patent, 1854, Day's patent, 1855, also Josylin's patent, 1855, in which, as Mr. Conant admits, gas rings are used. The construction and arrangement of Broadwell's device is very different from Conant's; and the latter, probably, would not be applicable to heavy cannon. There is nothing in Conant's patent that anticipates Broadwell's device or detracts from Broadwell's priority as the man who rendered possible the use of the heavy breech-loading ordnance of the present day. Broadwell's patent was not granted until September 21, 1875—more than nineteen years after Conant's—and up to the date of Broadwell's invention it can hardly be said that any one had produced a great gun that was really safe and reliable. Broadwell's rings are now in general use throughout the world.—ED. S. A.]

Calcined Oyster Shells for Cancer.

To the Editor of the Scientific American:

Your paper of June 4, 1887, contained an extract from the London *Lancet* relative to treatment of cancer with calcium carbonate. There being no physician here, I treated an Indian woman who had been afflicted with a cancerous tumor to my knowledge for over four years. A couple of months after using the remedy it commenced to improve. It is now so small that it can be said to be healed. I would advise any one having a cancerous tumor to use calcium carbonate as directed, and also think it well worth republishing.

W. H. WOODCOCK.

The following is the paragraph as published in the SCIENTIFIC AMERICAN of June 4, 1887.

CALCINED OYSTER SHELLS AS A REMEDY FOR CANCER.

In a recent number of the *Lancet*, Dr. Peter Hood, of London, refers to a communication of his published in the same journal nearly twenty years ago, on the value of calcium carbonate in the form of calcined oyster shells as a means of arresting the growth of cancerous tumors. In a case which he then reported, that of a lady nearly eighty years old, the growth sloughed away and left a healthy surface after a course of the remedy, as much as would lie on a shilling being taken once or twice a day in a little warm water or tea. He now reports another case of scirrhus of the breast, in the wife of a physician, in which the treatment was followed by an arrest of the growth and a cessation of the pain, the improvement having now lasted for years, and no recrudescence having thus far occurred. He urges that the remedy can do no harm, and that the *prima facie* evidence in its favor is stronger than that on which, at Dr. Clay's recommendation, the profession lately displayed an extraordinary eagerness to try Chian turpentine. He would restrict the trials to well marked cases of scirrhus, and insists that no benefit should be looked for in less than three months.

The Tannin Treatment of Phthisis.

Dr. E. Houze, of the Hospital St. Jean, Brussels, after having tried the tannin treatment on all his phthisical patients for the last year and eight months, states as the result of his observations that it gives excellent results in all stages of the disease, and especially in the condition where cavities exist. Indeed he has no hesitation in declaring that of all the different kinds of treatment for phthisis which he has tried this has given by far the most encouraging results. The dose he employs ordinarily is fifteen grains, which quantity is taken three times a day. It is, as a rule, well borne. Where this is not so, it is ordered to be taken with meals. After the first few days the expectoration and the sweats diminish, the cough decreases, and in many cases the appetite undergoes a marked improvement.

The majority of the patients suffered from some slight degree of constipation, though in some this feature was sufficiently marked to require treatment; while others, again, suffered from diarrhœa.

The character of the expectoration changed for the better, the sputa becoming white and frothy instead of green and firm. In some cases the diminution of the expectoration was followed by increased dryness of the cough, so that the patients complained that it fatigued them more. This was easily remedied by prescribing a few spoonfuls of sirup of codeia. The physical signs underwent a remarkable change for the better, at least those depending on auscultation, moist rales giving place to dry rhonchi, and large gurgling rales decreasing progressively until they gave place to mere blowing respiration. These changes were evidently due to the drying up of the cavities, in consequence of which the hectic present in many of the cases vanished, the patients increasing considerably in weight and gaining strength in a remarkable manner. The percussion signs were not found to undergo so marked a change as those dependent on auscultation, but even here some improvement could be detected. No bacteriological observations were made.—*Lancet.*

Dynamite Shells.

J. W. Graydon's invention has for its object to enable shells loaded with large quantities of dynamite to be fired from ordinary guns with the usual powder charge. The improvements consist mainly in subdividing the shell charge into a number of small portions or pellets, each consisting of a small quantity of dynamite inclosed in a flexible envelope of paraffined paper. A further subdivison of the charge may also be effected by means of partitions, perforated or otherwise. In order to prevent the dynamite from becoming fired by the heat generated by the explosion of the ordinary propelling powder charge in the gun, the shell charge is entirely surrounded by an envelope of non-conducting material, such as asbestos cloth.

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Home-made Perfumes.

There has been some discussion between two contributors of the *Druggists' Circular* regarding the practicability of druggists making their own perfumes at a profit. One says it cannot be done, the other says it can, and adds: "There is still something to be done in bottled perfumes, and when the make-them-yourself idea is applied also to those, it will give even better results" than the mere manufacture of the articles. "The druggist of average intelligence is already practically a perfumer, and the compounding of certain perfumes presents no difficulties greater than are met with in a new prescription. Moreover, in making such compounds the druggist will not only find a delightful occupation, but one which will yield him a handsome pecuniary return." The following are some of the formulæ which this writer recommends, the cost of production in no case exceeding 6d. per ounce:

White Rose.

Rose spirit	4 ounces.
Violet essence	2 "
Jasmine essence	1 ounce.
Patchouly extract	½ "

Essence Bouquet.

Rose spirit	4 ounces.
Ambergris tincture	1 ounce.
Orris	2 ounces.
Bergamot oil	¼ ounce.
Lemon oil	⅛ "

New Mown Hay.

Tonka tincture	4 ounces.
Musk "	1 ounce.
Benzoin "	1 "
Rose spirit	1 "
" geranium oil	40 m.
Bergamot oil	40 "
Alcohol (S. V. R.)	1 ounce.

West End.

Rose spirit	6 ounces.
Verbena extract	1 ounce.
Benzoin tincture	2 ounces.
Civet "	1 ounce.
Musk "	2 ounces.
Sandal oil	20 m.

Verbena.

Lemon grass oil	⅜ ounce.
Lemon oil	½ "
Alcohol (S. V. R.)	1 pint.

Heliotrope.

Vanilla tincture	8 ounces.
Rose essence	4 "
Orange flower essence	2 "
Ambergris tincture	2 "
Civet "	½ ounce.
Bitter almond oil	10 m.
Alcohol (S. V. R.)	ounce.

Microscopic Examination of Paper.

Mr. Herzberg, who has charge of the examinations of paper at Charlottenburg, has just published a very exhaustive work upon the subject, with numerous reproductions of microscopic preparations. He brings especially into prominence the peculiarities of certain fibers for rendering them easily distinguished.

The author uses a solution of iodine for recognizing the various fibers, which, according to their origin, assume various colors: (1) Wood wool and jute are colored yellow; (2) straw, "cellulose," and alfa do not change; (3) cotton, flax, and hemp are colored brown.

For disintegrating the paper, Mr. Herzberg does not employ the processes in common use. Mechanical appliances, either needles or a mortar, do not remove the size, starch, and weighing substances which in part conceal the structure of the fibers and render the examination of them difficult. He recommends that a small quantity of the paper to be examined be submitted to ebullition for a quarter of an hour in a 1 to 2 per cent solution of soda. In this way the foreign substances are got rid of and the fibers set free. The presence of wood wool will be ascertained, during the boiling, by the paper becoming yellow.

After this treatment, the whole is poured upon a brass strainer with fine meshes and is washed with pure water. The washed residuum is reduced to a homogeneous paste in a porcelain mortar.

In the case of colored paper, the coloring matter must be removed, if the boiling does not effect the removal. To this end, hydrochloric acid, chloride of lime, etc., is used, according to the chemical nature of the coloring matter. When the paper is not sized, nothing but water is used for the boiling. If the presence of wool in the paper is suspected, an alcoholic solution, instead of an alkaline one, is used, as the latter would dissolve the wool.

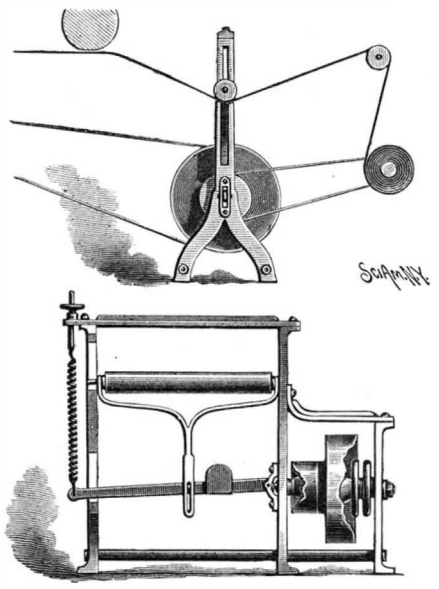
The solution of iodine in iodide of potassium may be more or less concentrated. The color produced varies in depth according to the concentration. The author generally uses the following formula:

Iodine	18 grains.
Iodide of potassium	30 grains.
Water	5 drachms.

For spreading the paste upon the object holder of the microscope he employs two platinum needles. The object holder is placed upon a white ground, so that the fibers will stand in relief more prominently. The paste is covered with a glass, and the excess of water is removed with blotting paper. For the determination of the fibers, a magnifying power of 300 diameters is best adapted; but, for ascertaining the relative proportion of the fibers, one of 120 diameters, that permits of taking in a wider surface, is preferable.—*Gutenberg Journal.*

AN IMPROVED AUTOMATIC CLUTCH AND TENSION MACHINE.

The illustration herewith represents a device primarily designed for use in printing labels or other matter in long lengths, where a web or strip is moved intermittently, and wound into a roll, the web being constantly taut. The invention forms the subject of a patent issued to Mr. Jeremiah C. Bill, of Willimantic, Conn. Upon the working shaft is a small, loose pulley, adapted to turn the winding drum by means of a belt, this pulley being adapted to be clutched to a larger fixed one on the shaft by friction or otherwise, each pulley having preferably, on the opposing faces, rubber or leather. The tension bar or roller under which the strip from the press passes has its shaft or gudgeons in slots of the main frame, the bar being mainly supported from a lever whose outer end is sustained by a coiled spring, while its inner end is pivoted in a bracket attached to the frame, in line with the operating shaft. The inner end of this shaft is slotted, and in the slot is a pointed plate, the point impinging against the end of the lever below its pivot, so that vertical movement of the tension bar or roller will impart a horizontal movement to the plate in the shaft slot. This plate is connected to a sleeve or ring placed loosely upon the shaft, and impinges against the boss of the



BILL'S AUTOMATIC CLUTCH AND TENSION MACHINE.

small, loose pulley, so that the outward movement of the plate forces the pulley in contact with the operating pulley. With this construction, between each impression of the press the strip is free, but it is otherwise kept constantly taut, and wound into a perfect roll upon the drum, the machine being entirely automatic. This machine is also equally applicable to the winding of paper from the paper machine, cloth from the loom, and other similar uses. By simply inserting the lever and bracket it will as well discharge from a roll, its action being governed entirely by the tension.

Injury to One of the Pneumatic Guns of the Vesuvius.

The guns of the new torpedo boat Vesuvius were tried near Philadelphia on April 24. The adjustments of the firing valve, which have caused considerable delay, had been satisfactorily made, and it only remained to prove that a two hundred pound shell could be thrown to all ranges inside of one mile and at the rate of one in two minutes.

Three dummy shells were fired successfully, the range being a little less than one mile. The fourth shell was different from those first fired, being a ten inch sub-caliber hollow cast iron shell, weighing 500 lb. It was placed in the middle gun, and when that gun was fired, the hollow cast shell immediately went to pieces in the gun. The breech section of the gun was badly wrecked and considerable damage was done to the mechanism. No one injured.

Photographing Patterns.

Sterling Elliott sends to the *American Machinist* the following plan for keeping track of patterns:

Spread a white paper on the floor, lay patterns on it in proper order, place on each pattern a small square of white paper on which is painted a black plain figure beginning with one, two, three, etc.; these may be cut from an old calendar, or painted purposely. Directly over the patterns suspend by any suitable means a photographic camera, and you have it. From the negative thus obtained, make two blue prints; send one to the foundry, and the old problem of marking patterns is not only solved, but lost patterns are much more easily found; for a pattern, unlike an actress, resembles its photograph every time.

Purification of Coal Gas by Oxygen.

The manufacture of cheap oxygen by the Brin process has rendered it possible to use this gas for destroying the sulphureted hydrogen present in crude coal gas. Mr. Vernon Harcourt, one of the gas referees for the metropolitan district, suggested some two or three year ago that oxygen gas would probably be found valuable for revivifying and keeping in an active condition the oxide of iron in the gas purifiers. When air is used for this purpose, it is necessary to remove the oxide of iron from the purifiers, or cause a lowering of the illuminating power of the gas; but if pure oxygen be employed, it can be introduced directly into the purifiers *in situ*, which can then be kept in constant use.

Mr. Ogden, the engineer of the Blackburn Gas Works, acting upon these views, found the process to work well in practice, and after an extended trial showed that this continual revivification of the oxide of iron had many advantages over the older method. The nuisance caused by opening the purifiers, and the loss of gas consequent on doing so, were prevented, and the labor of cleaning and recharging the purifiers saved. After these satisfactory results had been obtained at Blackburn, Mr. Valon conducted a series of experiments at the Westgate-on-Sea Gas Works. Mr. Valon found that by introducing pure oxygen into the purifier without removing the oxide of iron, a slight increase in the luminosity of the gas was produced, and the revivification of the oxide proceeded more regularly than in the former process. From the increase of luminosity of the gas, he was led to study the effect of mixing a limited amount of oxygen with the crude coal gas without the use of any oxide of iron purifiers, and found that under these conditions the lime purifiers alone were sufficient to efficiently remove the sulphur compounds present in the gas.

The proportion of oxygen which gives the best results appears to be 0·1 per cent of the volume of the gas for every 100 grains of sulphur per 100 cubic feet of crude gas. The sulphur remains fixed in the lime purifiers partly as free sulphur. The sulphur did not move forward when the lime became saturated with carbonic acid, as is the case where air is employed, and the lime could be used for about twice the usual length of time. The spent lime forms an almost odorless and dry substance, and has none of the objectionable characters of "blue billy." Permanent oxygen plant has recently been put down at the Ramsgate Corporation Gas Works, and it occupies only one-half the space which would be required for the purifying plant if oxide of iron were employed.

The chemist to Brin's Oxygen Company, Dr. L. T. Thorne, has not given any explanation of the chemical changes involved in the process, but it is obvious that the sulphureted hydrogen is partially burnt into oxidized sulphur compounds, which are subsequently absorbed by the lime. He states, however, that there is some free sulphur in the lime, and it would be interesting to know what proportion of the sulphur removed from the gas is in this condition. If the free sulphur forms a large percentage of the total fixed sulphur it may be possible that the process will resolve itself into a modification of the "Claus" sulphur recovery process, now at work at the Belfast Corporation Gas Works, and that the lime merely acts as a strainer or filter, and could therefore be replaced by coke or other material. If, on the other hand, the greater proportion of the sulphureted hydrogen is burnt by the oxygen into sulphur acids, which are absorbed by the lime, oxygen purification is not likely to be found as economical as the Claus process.

In the former, the gas manufacturer will have to buy both oxygen and lime, and sell a comparatively valueless sulphate of lime, while in the latter practically no lime is required, and the sulphur is recovered in a form which commands a good market for the manufacture of arsenic-free sulphuric acid. The slight increase in the luminosity of the coal gas is, however, an important factor in the problem. Many gas engineers would be glad to avail themselves of a process which would insure the luminosity of their gas being raised even a few tenths of a candle, and if a small quantity of free oxygen can be guaranteed to produce this effect, it should be a useful adjunct for rapidly improving the illuminating power of the gas.

We understand, says *Industries*, that the difficulties at first encountered in the manufacture of large quantities of the gas are now surmounted to such an extent that it is possible to produce oxygen by the Brin process in London at a price not exceeding 7s. 6d. per 1,000 cubic feet. In manufacturing districts, where fuel and labor cost less than in London, 1,000 cubic feet should not cost more than 5s., and in gas works and other large works where special facilities exist, a further reduction in price is possible.

Patents, Partnership, Property.

In a case where an invention is put in as part of the capital stock of a partnership, a patent granted on the invention becomes partnership property, according to the decision of the Supreme Court of California in the case of Hill *vs.* Miller.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SLEEPING CAR BERTHS. — Simon Cullen and Carver C. Brown, Alexandria, La. This invention provides a ladder attachment for such berths, by means of which a person can readily get into and out of a berth, while it can be used as a guard to keep one from falling out of a berth, and folded up out of the way when not in use.

ELECTRIC TRACK ALARM. — Theodore Taylor, Cedarville, Cal. Combined with the railway rails are conductors connected therewith by suitable fastenings, insulated and arranged to form a complete electric circuit, including a battery and an alarm device, for indicating when the track is broken or displaced.

PNEUMATIC TRACK ALARM.—This is a further invention of the same inventor, with a similar object, to give an alarm when any of the track rails are broken or displaced, the invention consisting of pipes extending along the flanges of the rails and connected with an air pump and a signal for denoting when a rail and pipe break.

Mechanical.

PIPE CUTTER. — Vernon B. Stevens, Bridgeport, Conn. This invention is designed to cheapen and improve the construction of cutters employing circular cutting blades pivoted in a jaw and stock adjustably connected together, the stock being recessed and the lower cutter blade placed therein and directly connected to the handle, avoiding all connection of the cutter block with the outer curved jaw.

BALING PRESS MECHANISM. — George Ertel, Quincy, Ill. The special object of this invention is to provide a simple, efficient, and inexpensive power mechanism for giving two effective strokes of the plunger in the baling box for each complete rotation of the sweep, one bale being pressed behind another as the tied bales are discharged from the contracted open rear end of the press case.

BOX FOR SHAFTS.—Edward H. Bridgman, Pittsfield, Mass. This invention relates to adjustable boxes for slitter shafts, in order that when the dekle straps on a paper-making machine are not set correctly, the slitters on the shafts running in these boxes may all be moved with the shaft, forward or backward, to properly cut or divide the sheet of paper, or trim both edges alike.

BASKET MAKING MACHINE.—Isaac J. W. Adams, Laurel, Del. In this machine a form is used comprising semicircular metallic plates registering to form rings of varying diameter, provided on their inner faces with hoop-receiving spaces, semicircular spaced hinged ribs, to the inner faces of which plates are secured, and semicircular bars securing the ribs of each section together.

WELL BORER. — Benjamin Andrews, New Orleans, La. A boring head is journaled to the well tube, while a water tube is connected with the boring head and constructed to fit snugly therein, whereby water forced down the water tube will be prevented from passing up between it and the boring head, with other novel features, the invention being an improvement on a former patented invention of the same inventor of apparatus for boring artesian wells.

PRINTING MACHINE. — William O. Nelson, Baltimore, Md. This is intended for the hand stamping of dates, addresses, etc., and particularly adapted for desk use in offices, a rubber type plate being preferably used, attached to a type carrier that reciprocates vertically and descends into contact alternately with the inking pad and the surface to be printed, the pad being attached to a horizontally reciprocating platen.

Miscellaneous.

KITCHEN SAFE, ETC.—David Pentz, Shippingport, Pa. This invention provides a combined article, adapted for use as a bread raiser as well as a bread safe or table, consisting of a box with a double hollow bottom, in communication with which is a lamp chamber, the box being metal lined, and embracing various novel features in its construction.

GATE.—Thomas Tyson, Mound City, Mo. This is a gate especially adapted for farm use, being of simple and durable construction, and of such design that it may be opened from either side by the weight of the vehicle or by a person walking or riding along the road.

CAMPAIGN BUTTON.—Leon Winterdorf and August Reymond, New York City. The button head is made hollow and fitted with a slide, on the face side of which is to be delineated the desired portrait, which is adapted to be drawn out when desired, the portrait slide when released being automatically returned to its normal position within the button again.

LACE PIN FASTENING. — Milton E. Oppenheimer, New York City. In this fastening is a tube having a pin slot, a sleeve surrounding the tube and adapted to close the slot therein, and mounted on the body of the pin in position to engage and secure it against accidental unfastening.

LOOP TIE. — Josephine Muller, New York City. This is a tie for decorative scarfs or similar articles, and consists of a broad ornamental loop, with a relatively long cord attached thereto at one end, and with an ornamental appendage attached to its free end, being especially adapted for use in draping decorative scarfs applied to sofas, lounges, etc.

SAFETY SCAFFOLD.—John Carmichael, Brooklyn, N. Y. This is a scaffold for use by painters, masons, etc., and consists of adjustable back railing and end railings, all adapted to be secured to the ordinary scaffold, or detached therefrom and folded up when not in use.

WIRE FENCE. — William H. Mitchell, Horse Cave, Ky. This invention covers a novel construction and combination of parts whereby the several wires of a fence are kept at the same tension, and any strain thrown upon a single wire will be distributed between all the wires, while the wires will be kept tight in both hot and cold weather, and the tension on them may be adjusted as desired.

BEER ENGINES.—James A. Bigelow, Melbourne, Australia. This invention covers an apparatus for drawing beer or other liquids from a receptacle in a cellar or store room, and delivering it to a bar counter, whereby also the beer or liquids may be cooled as desired, and several kinds of beer may be mixed before delivery.

DUMPING WAGON. — William Jachmann, New York City. Two nuts are connected with each other by a rod passing through recesses in the wagon body, upright screws being also held to turn in suitable bearings, on which screw the nuts and a turning mechanism located under the wagon body operate to impart a rotary motion, whereby the body can be quickly and easily raised to an inclined position to dump its contents.

BUILDING PAPER. — George Manahan and Henry Gade, New York City. This invention covers a composition for waterproofing and preparing sheathing and building paper, in which are used glue, amber mineral oil, and other ingredients, prepared and applied as specified.

WATER GATE.—Thomas A. Niswonger, Cleveland, Tenn. This gate is intended for use on small streams, and also as a flood fence, stout posts being sunk into the ground on opposite sides of the stream, supported by inclined braces, while the inner side of each post and brace has an inclined strip which forms a bearing for the axis of the gate.

DESK AND DRAWING BOARD.—Henry L. Keith, Stockton, Cal. This is a simple and inexpensive construction designed to serve as a writing desk, drawing board and easel, being capable of being readily adjusted for either of these uses, and so made that when not in use it can be folded up in small space.

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2. Elegant plate, in colors, of a residence of moderate cost, with floor plans, details, etc.
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4. A cottage at East Orange, N. J. Plans and perspective.
5. Page engraving of a stairway in the Chateau de Chantilly. By Mr. H. Daumet.
6. Scenes at Zaandam, Holland, where the Czar Peter the Great learned shipbuilding in 1697.
7. Engraving of the new station and offices of the Great Indian Peninsular Railway, Bombay.
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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(759) L. A. V.—The chipping off of the porcelain lining on iron kettles is of no possible harm in the cooking of vegetables. Acid fruits stewed in such kettles turn dark in color and often taste of the iron, which injures the flavor only. Granite ware is the same as porcelain-lined in its cooking properties, but with chipped ware the flavor of the article cooked in it will be damaged. There is nothing unhealthy in the use of chipped porcelain-lined or granite ware.

(760) F. & M.—Cement for filling brass and zinc signs is made by mixing asphalt, shellac, and lamp black about equal proportions, or black sealing wax may be used. Apply by heating the plate and melting the cement in and evening the surface with a warm iron. Then carefully scrape off the excess and hold a hot iron over the letters to glaze the surface. Any ordinary sheet brass or zinc is suitable for signs. They are engraved, etched, or stamped. Nitric acid 1 part to 1, 2, or 3 parts parts of water is used for etching. There are no books on the subject of sign making. "The Etcher's Guide," by Bishop, we can mail for $1.

(761) J. W. B.—"Crawley" root is a corruption of coral root, the popular name of the plant *Corallorhiza odontorhiza*. The plant is an orchid and grows in rich woods from New York to Michigan, and especially southward. The generic and popular names refer to its much-branched and coral-like rootstocks, the shape of which has given it also the name of dragon's claw. Medicinally (mostly in eclectic and domestic practice) the root has been used as a diaphoretic in fevers and inflammatory affections. The plant is small, yellowish, with a rather fleshy, leafless, purple sheathed stem, 8 to 12 inches high. The flowers, 10 to 20 in number, grow in a long spike, are small and purplish and spurless, and the lip, which is dilated and white, is finely spotted with purple. These are the main botanical features.

(762) G. H. M. asks: What would be the lifting power of a propeller 10 feet in diameter on a vertical shaft running six hundred revolutions per minute in air, also the best pitch for blades of propeller, and how much power would it require? A. You may obtain a lifting pressure of from 15 to 20 pounds per square foot if the fan is arranged for the best blast. The pitch should be about 35° to the plane of motion. 15 to 20 horse power will be required.

(763) E. T. H. writes: I have an engraved copper plate and wish to print the same on my photographic mounts. Please inform me how to do this. A. It will probably have to be done by a regular copper plate printer. The plate must be perfectly clean and highly polished. It is warmed, and inked while warm, the ink being applied with a dabber or roller. The surface is then wiped with a cloth in two directions, and finally with the palm of the hand sprinkled with a very little whiting. The edges are then wiped off, the paper or card is put on it, and covered with some thicknesses of cloth or blanket, and the whole resting on a steel plate is passed through the rollers of a copper plate press. The ink in the grooves of the plate is transferred to the card. A very intense pressure is needed to effect the printing.

(764) Q. A. S. asks: 1. Will you give me the receipt for a fireproof cement? I wish to pour it into a complicated mould, then have it harden, take it out of mould, and submit to intense heat. A. You can use clay, introducing it into the mould by pressure. You will have much difficulty in obtaining a mixture that will pour and give any satisfaction. Plaster of Paris mixed with silicate of soda and water might answer, but would not stand really intense heat. 2. If two copper pipes (1¼ inch diameter) were brazed together with a 90° miter joint, would the joint stand 300 pounds cold pressure? A. Yes. 3. If the pipes were of steel and I had the joint electrically welded, would they then stand the same pressure? A. It would be stronger than a brazed joint between the same metals.

(765) J. G. I. asks: 1. Have the attempts which have been made at working the typewriter by electricity (so that letters might be printed at any given distance apart) proved successful? A. Yes. 2. If so, is there a wire to carry the current of electricity, for each letter, numeral, and point represented on the keyboard of the typewriter, or does one wire furnish the current for the working of the whole instrument or instruments? A. One wire is sufficient for all of the operations.

(766) J. P. S. asks: Does the current or message sent over a telegraph line with ground wires at each end pass through the earth to the starting point the same as if a return wire is used instead of the earth? A. The earth becomes practically a common reservoir of electricity. It does not act as a return wire, as the current becomes diffused. The separate impulses are lost.

(767) J. W. F. asks: 1. How gilt edging is put on scolloped cards? A. In gilding the edges of cards, bronze powder is used, which is applied to the cards in packs by first brushing the edges with a thin size, and when nearly dry the powder is applied with a piece of soft chamois or fur. 2. What is the composition that is put on tablets in the place of glue, and which is flexible? A. The tablet composition is glue, with a little glycerine added to keep it from hardening. The glue is sometimes colored with aniline purple or red. We can send you Holbrook on "How to Strengthen the Memory" for $1.

(768) F. S.—The pressure of the steam on the piston is not equal through the stroke, and the pressure on the crank pin is also variable with its position at various points in its revolution. The office of the flywheel is to equalize these variable forces as much as possible. In practice the flywheel and attached machinery has a perceptibly increased speed when the crank pin is near the point represented by the middle of the piston stroke. Centrifugal force has much to do with the vibration of machinery. Unequal balancing is the direct cause. See the "Practical Steam Engineer's Guide," by Edwards, which we can mail for $2.50.

(769) J. Z. G. asks how to mix plumbago in order to make a mould for casting small articles in lead. A. Mix with 10 per cent pipe clay and water to make a stiff putty. Shape the mould and dry in an oven. If to be much used, bake at a red heat.

(770) E. M. C.—Bagging or bulging of boiler plates over the fire is in nearly every case traced to the use of oil in the boiler. Oil is sometimes inadvertently fed to boilers by the false economy of turning the exhaust steam into the water tank, where the engine oil is caught and pumped into the boiler. Oil gathers the scum and dirt into a cake, which may settle on the fire sheet and thus prevent contact with the water. The intense fire heats the iron red hot and the pressure bulges the plate. Scale, if allowed to accumulate in large quantities, may possibly also cause bulging, but we have yet to see the first case in a cylinder boiler that was not traced to oil.

(771) B. S. T.—For belting the wooden pulley gives the best friction, or allows the least slip.

(772) J. S. B. — Steel tapes have the divisions and figures printed with an acid resisting ink and are then immersed in weak acid to etch the background, which leaves the figures bright after the ink is cleaned off.

(773) J. H. S. asks: 1. What is the national air of America; if America, is it not the same as "God Save the Queen," and who was the composer? A. Probably "America" and the "Star Spangled Banner"

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would be about equally considered national airs. The music of the former is substantially the same, as that of "God Save the Queen," or "God Save the King," as it was first known. There is every reason to believe that the tune was composed in the time of James I., by Dr. John Bull, but it was not by him used for a national hymn. One Anthony Young, organist of All Hallows, Barking, adapted it to a "God Save the King," for James II., at the time when the Prince of Orange was hovering over the coast, but it was not so used until the time of George II. A letter from Victor to Garrick, October, 1745, mentions that it was sung at both theaters nightly amid great applause. It is a singular coincidence that Young's daughter was married to Arne, who composed "Rule Britannia." Mrs. Arne received a pension of £30 a year. In 1789 Mrs. Henslowe, who was grand-daughter of Mrs. Arne, received £100 from the government as "the accumulated amount of a yearly pension of £30 a year, awarded to Mrs. Arne as the eldest descendant of A. Young, the composer of 'God Save the King.'" The tune is almost a literal translation of a *cantique* sung by the Demoiselles de St. Cyr, when Louis XIV. attended morning prayer at that chapel. The words were by M. De Brion, and the music by the famous Sully. The "Star Spangled Banner" was first applied to the flag of the United States in a poem written by Francis S. Key, on the morning after the British attack on Fort McHenry at Baltimore in 1812. The bombardment, which took place during the night, was witnessed by Mr. Key, who with some friends watched with intense anxiety for the return of day. At length the light came, and they saw the American flag still flying from the fort, the attack having failed. In the excitement of the moment he wrote the now famous song, the first verse of which so graphically describes the scenes of the night and morning. 2. Will a No. 3 pump, on a two inch pipe, throw water faster, than a No. 2 pump on same piping (well 20 feet deep)? If so, why? A. There are similar proportions in the steam and water pistons of most pumps. The water pressure would be nearly the same in No. 2 and No. 3 pump of the same make. The only gain a No. 3 pump would have is to throw more water with less speed. The piping should be of the assigned sizes due to the size of the pump for a proper proportion of work. 3. When a tree is felled, what force draws it in falling away from the stump? A. The manner in which a tree falls is largely due to the skill of the woodman, who takes advantage of the wind, the way the tree stands, etc.

(774) H. A. M.—Brick tiling on flat roofs cannot be made tight with cement. The tiles will absorb water. The cement will also open a little by the sudden shrinkage from the heat of the sun to the temperature of falling rain. We can only recommend a coat of coal tar, which allow to dry and then put on a thick coat of coal tar and asphalt, put on hot, and spread over with clean coarse sand, thick enough to keep the tar and asphalt from running by sun heat. See answer to Query 601, in our issue of April 13.

(775) B. V. G. asks (1) how a cable car rounds a curve. A. The cable is kept in place by flat-faced pulleys on vertical shafts, arranged around the curve, so as to just clear the grip in its passage around the curve. The grooved pulleys carry the cable just below the bottom of the grips, so that the cable in the grip is raised out of the pulley groove when passing. 2. Why the steamboats using electric headlights have the headlight glass cut in strips about ⅞ inch or 1 inch wide. A. The glass in the headlights is cut into strips to prevent breakage from the high heat of the arc.

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NEW BOOKS AND PUBLICATIONS.

MAY TIME. A compilation, by Marcus Benjamin, of sundry poems. 84 pp. 25 cents. New York: De Witt Publishing House.

EXAMINATION OF WATER FOR SANITARY AND TECHNICAL PURPOSES. By Henry Leffmann, Ph.D., and William Beam, M.A. Philadelphia: P. Blakiston, Son & Co. 1889. Pp. 106. Price $1.25.

This convenient little manual contains within small compass an excellent *resume* of methods of water analysis. The determinations of solid matter, of nitrogen in its various forms, of phosphates and oxygen required to oxidize organic matter are all treated. The all-important subject of interpretation of results has devoted to it a special chapter. A chapter giving analytical data and an index close a very useful work.

INDEX OF PUBLICATIONS ON METHODS OF COMMUNICATION IN THE FIELD AND ON TORPEDO WARFARE. By R. Von Fischer-Treuenfeld. London: Alabaster Gatehouse & Co.; New York: D. Van Nostrand. Pp. v, 71.

The title of this book tells its story. From military telegraphy, through signaling, both audible and visible, ballooning, carrier pigeons, dogs and velocipedes, torpedo service, electric light apparatus, and many other subjects, down to cryptography, the literature is indexed in twenty-nine divisions. This gives the titles of the papers and publications. An index of authors' names, referring back to the main work, completes it, giving an excellent presentation of the subject.

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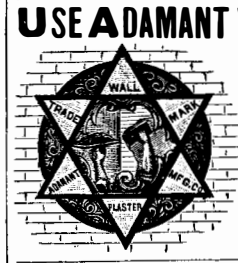

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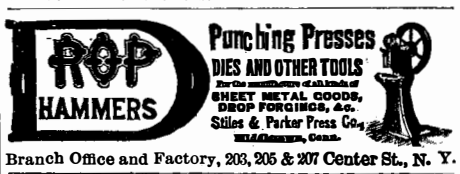

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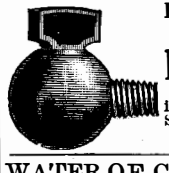

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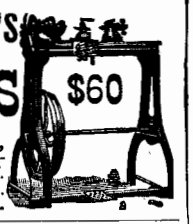

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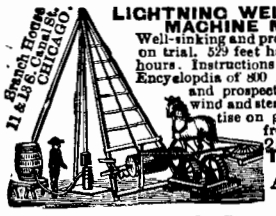

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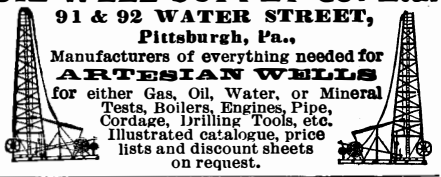

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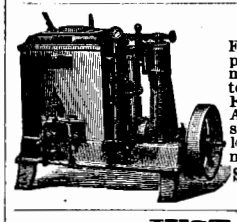

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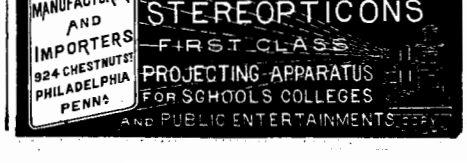

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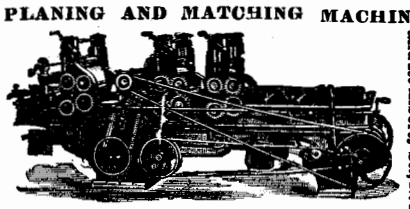

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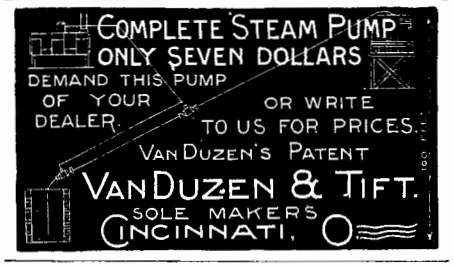

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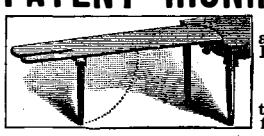

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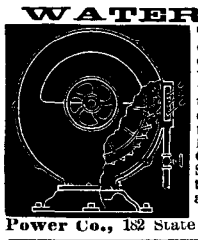

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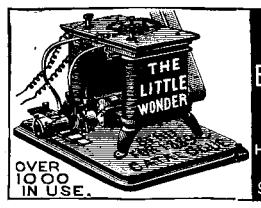

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JAS. B. BOUSTEAD, *Chairman Committee on Water Works.*
WATER WORKS DEPARTMENT,
City Hall, Toronto, Ontario,
12th April, 1889.

Proposals for Dredging.—U. S. ENGINEER OFFICE, CLEVELAND, O., *April* 20, 1889.—Sealed proposals in duplicate will be received at this office until 12 o'clock M., on Wednesday, the 8th day of May, 1889, and then opened, for excavating 760,000 cubic yards, more or less, of material from Maumee bay along line of proposed straight channel for Toledo harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, vol. 23, page 332, and vol. 24, page 414, statutes at large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals.
L. COOPER OVERMAN, *Major C. of Engineers.*

Sealed Proposals, in triplicate, will be received at this office until noon, local time, Thursday, May 23, 1889, for furnishing the labor and material required in constructing a Snagboat. Specifications will be furnished bidders on application, and detailed drawings can be examined and all necessary information obtained at this office. Proposals will only be considered from those who can give satisfactory evidence of their ability to construct the boat as required and in the time specified. The United States reserves the right to reject any or all bids. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. D. W. LOCKWOOD, *Major of Engineers, U. S. A.*, U. S. Engineer Office, Custom House, Cincinnati, Ohio, *April* 23, 1889.

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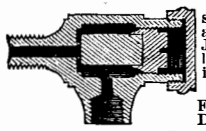

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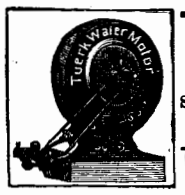

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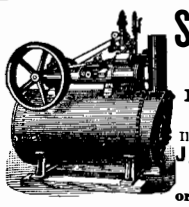

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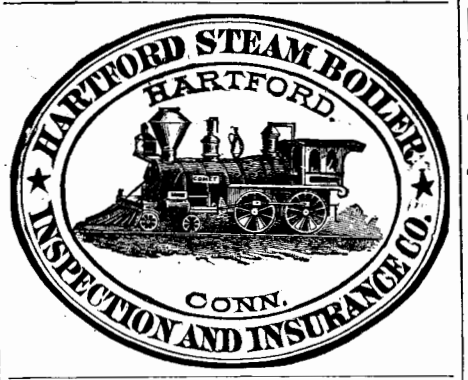

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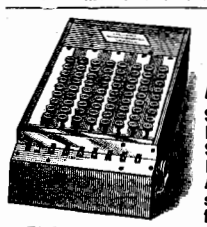

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